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Prepared to assist those planning the construction of new science facilities on the elementary, intermediate, or secondary school level. Standards are outlined and specifications detailed. A statement of fifteen general pricniples for planning science facilities in secondary schools precedes a discussion of--(1) special facilities for different courses, (2) standards for furnishing laboratories, (3) suggestions for remodeling the present science laboratory, and (4) recommended audiovisual facilities. Facilities for science instruction in the elementary school and basic equipment requirements are discussed. A twenty point check list for the furnishing of a science room is also given. The appendices provide similar checklists for general science, biology, chemistry, and physics. The findings of science teachers' opinions regarding the relative importance of types of available equipment for laboratories are reported, and a bibliography is included. (FPO)

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SCIENCE FACILITIES
FOR
MISSISSIPPI SCHOOLS

GRADES 1-12

Division of Instruction
State Department of Education - Jackson

J. M. TUBB
Superintendent

EF002074

SCIENCE FACILITIES
FOR
MISSISSIPPI SCHOOLS

GRADES 1-12

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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DIVISION OF INSTRUCTION

STATE DEPARTMENT OF EDUCATION - JACKSON

R. C. Roberts, Supervisor of Science
S. A. Brasfield, Director, Division of Instruction
J. M. Tubb, Superintendent of Education

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FOREWORD

This bulletin has been prepared for the purpose of assisting those who are planning the construction of new science departments or who may be planning the improvement of existing facilities. It represents the results of approximately two years of studying and evaluating science departments in a large number of schools, of studying similar bulletins and other literature relating to this subject, and of consulting with many individuals trained and experienced in the field of science education. It is hoped that this publication will prove to be helpful to the school superintendents, local planning committees, the architects, the equipment suppliers, and others who are working with the problems of improving science facilities.

This is the second of a series of publications related to the improvement of science instruction in our elementary and secondary schools. The first publication dealt with equipment and materials; and the third publication, which is in the process of preparation, deals with science curriculum - grades 1 through 12.

It is believed that the school administrators and science teachers of our state will continue to evaluate their science departments and will seek to provide science instructon whch is demanded in the scientific world of today and in the future.

J. M. TUBB
State Superintendent of Education

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This bulletin is a product of the cooperative efforts of a large number of persons. It would be difficult to list the names of all the persons who made contributions to the preparation of the manuscript for this publication; it would also be difficult to list all of the organizations and publishers who permitted us to use and/or quote from their publications.

The manuscript was prepared under the direction of R. C. Roberts, Supervisor of Science Education in the Mississippi State Department of Education. Other members of the Department who made major contributions to the preparation of the manuscript were Robert C. Jones, Assistant Director of the Division of School Buildings and Transportation (an architect); E. Harold Fisher, Supervisor of Elementary Education; and W. D. R. Stovall, assistant Coordinator of Title III of the NDEA and Supervisor of Audio-Visual Education.

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The following persons reviewed the original manuscript and made many valuable suggestions which were included in the final draft of the bulletin.

State Science Advisory Committee:

Mrs. Genevieve Adams, Chemistry Teacher, Hinds Junior College, Raymond

Otis Allen, Superintendent of Leflore County Schools, Greenwood

Dr. Samuel F. Clark, Chairman, Department of Chemistry, University of Mississippi, University

Miss Lucille Horton, Northwest Junior High School, Meridian

James McBay, Bay Springs High School, Bay Springs

Melbourne Miller, University High School, University

Mrs. Sara Richardson, Chemistry Teacher, Copiah-Lincoln Junior College, Wesson

Dr. Clyde Q. Sheely, Professor of Chemistry and Executive Secretary, Mississippi Academy of Science, Mississippi State University, State College

James K. Upchurch, Bailey Junior High School, Jackson

Dr. J. F. Walker, Chairman, Division of Biology, University of Southern Mississippi, Hattiesburg

State Department of Education:

Dr. S. A. Brasfield, Director of the Division of Instruction

A. P. Bennett, Supervisor of Secondary Education

Dr. Lamar Fortenberry, Coordinator of Negro Education

A. A. Alexander, Assistant Supervisor of Negro Schools

Jackson State College:

Ivory Manning, Chemistry Department

Bolton Price, Chairman, Biology Department

Through the courtesy and assistance of the Directors of the National Science Foundation Summer Institutes of 1960 in Mississippi, the following institute members met with the State Supervisor of Science Education and offered suggestions relative to laboratory facilities needed for providing an adequate program of science education in our schools; and also completed a questionnaire, the results of which were tabulated and are listed in Appendix E of this bulletin.

Mrs. Sara Bayles, Itta Bena

W. O. Benjamin, Indianola

J. M. Bennett, Greenville

Mrs. Louise K. Bishop, Rolling Fork

C. H. Dhonau, Wharton County Jr. College, Wharton, Texas

Frank Drake, Inverness

Robert J. Durr, Greentown, Indiana

Harry Foster, Winona

Bobby Kemp, Quitman

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We should also like to thank school personnel, representatives of school supply companies, and architects, for the use of photographs, pictures, sketches and drawings (floor plans and science layouts) which are included in this publication.

We should like to express our deep and sincere appreciation to all persons who made contributions to this publication.

S. A. Brasfield, Director
Division of Instruction

PART I

SECONDARY SCHOOL SCIENCE FACILITIES

CHAPTER I

GENERAL PRINCIPLES FOR PLANNING SCIENCE FACILITIES

A. Adequate Space Should Be Provided For a Variety of Activities in Science.

In planning the building area for science instruction, provisions should be made for space sufficient for an activity centered curriculum. An activity centered curriculum requires a minimum of 50 sq. ft. per pupil. Of this amount, approximately 40 sq. ft. per pupil should be in classroom laboratory space and 10 sq. ft. per pupil devoted to storage rooms, darkroom, and preparation room. The proportion of classroom-laboratory space to storage rooms, etc. (4-1) may vary depending on the extent of the storage facilities provided by the laboratory furniture in the classroom-laboratory.

As a general rule the number of rooms needed will be one for each 250 students enrolled in school, grades 7-12, or fraction thereof. For example, an enrollment of 350 students would require two rooms.

Another formula is based on anticipated enrollment in science.

$$\text{Number of rooms} = \frac{\text{student-periods}}{\text{average class size} \times \text{number of periods per week}} = \overset{\text{using data below}}{\frac{275 \text{ x } 5}{24 \text{ x } 30}} = 1.91$$

The quantity, "student-periods," is determined by multiplying the number of students in a given course by the number of times that a given class meets per week. For example, 275 students in general science or biology meeting five times per week would require 1.91 rooms, assuming a school day of 6 periods and an average class size of 24.[1]

A third method of computing space requirement would be to anticipate the actual enrollment in science and assume that a maximum of 150 students could under best scheduling conditions be taught in one room. If all students in a junior high school of 750 students are to be taking science, then 5 rooms should be provided.

A larger per pupil area should be provided in science facilities today than was formerly provided, for three principal reasons:[2]

1. An increased emphasis on small-group and individual work requires more space than is required in a more formal type of classwork.
2. A wider range of activities employed in the teaching-learning process requires that increased work area be provided.
3. Science teaching today involves a greater quantity and quality of materials than was true formerly. Through NDEA financial aid most schools have been able to obtain much needed equipment and materials. It logically follows that more space is required for use and storage of the equipment.

B. A Combined Classroom-Laboratory Will Require a Larger Space Than Separate Lecture Room or Separate Laboratory Room but Less Than the Separate Lecture Room and Separate Laboratory Room.

A combined lecture-laboratory room is more economical particularly in the smaller school system.

A combined laboratory-classroom should have in excess of 1000 sq. ft. exclusive of storage areas, assuming that some classes may have more than 25 students. A wide room such as a 30' x 40' room would permit peripheral arrangement of student tables. A square room is even better for peripheral arrangement.

A narrow room such as a 24' x 46' would lend itself to an arrangement of student tables at one end and the lecture area at the other end of the room.

C. Proper Utilities, Gas, Water, and Electrical Outlets, Should Be Provided in the Building Plans According To Subject Areas To Be Taught.

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[1] Richardson, John S., ed., "General Aspects of School Science Facilities," **School Facilities for Science Instruction**, ch. 2, National Science Teachers Association (1954), p. 19.

[2] McCollum, Howard, "Some General Considerations in Planning Facilities for Science Instruction," **Facilities for Teaching Science**, Section 1, Louisiana State Department of Education (August 1960), p. 3.

If funds are inadequate for both building and furniture it would be much better to properly equip the building with necessary plumbing and wiring and add furniture as funds may permit.

With regard to needed utilities we may classify rooms according to type of instruction envisaged, for example:

General Purpose Room: Student tables should be fully equipped with water, sinks, gas and electricity. Proper utilities to service other units such as demonstration desk, fume hood, wash-up sink, preparation room, audio-visual equipment, and darkroom equipment should be considered.

Chemistry-Physics Room: All utilities are needed on the student tables as in the General Purpose Room. Attention should be given to fume hood requirement, electrical wiring for physics project room, etc.

Biology-General Science: Two options may be considered acceptable:

Option 1. Student tables may be fully equipped.

Option 2. The room may be provided with biology tables without utilities, but in this case wall counter tables would provide a number of sinks, water, gas, and electrical outlets. Service Islands may serve this purpose. The use of microscope lamps and projection equipment require electrical outlets.

Physics Room: Physics tables must have outlets for gas, and electricity, and water must be available in the room. Laboratory volt units, circuit breaker, and other power control units may be needed.

D. Rooms Utilized for Science Instruction and Adjacent Rooms Should Be Planned and Equipped To Provide Flexibility in Their Use and To Provide for Future Needs Brought About By An Increase in Pupil Population and Changes in the Curriculum.

Furniture and equipment in the science room should allow for regular class work, group work, and individual laboratory experiences. Movable student tables or tablet arm chairs provide flexibility in classroom activities.

In science teaching, individual differences in interests, abilities, and ways of learning must be recognized. Pupils learn to do by doing. These basic beliefs in education must be practiced in the kind and the arrangements of furniture that are provided.

In planning school buildings, it is desirable to plan one or several classrooms of the proper size adjacent to the science department, with roughed-in plumbing and provisions for gas and electrical services so that the room or rooms can be easily converted for science teaching if the need should arise. Adequate planning prior to constructing the school plant may mean the difference between a science department that meets evolving needs and one that only partially meets those needs. Also, it may mean the difference between providing a department with a minimum expenditure of money and providing one that is far more expensive than it should have been.

E. Student Tables Should Have Adequate Surface Work Area and Provide Some Individual Storage Space.

Tables should provide sufficient work surface for the number of students which they are to accommodate. A minimum of 5 sq. ft. of table surface area per student should be available.

A four-student table (size 4' x 4') would be inadequate for many experiments in general science and physics. A table top 4' x 5' should provide sufficient work surface, except possibly for a few experiments in physics. Students may complete experiments within the period if individual equipment is at hand.

F. Adequate Facilities for Demonstration Purposes Should Be Provided.

A demonstration desk should be in every room where science is taught.

Many experiences in science may be gained through the demonstration technique. The desk top height should be above that of student tables, and desk should be located near the supply of demonstration equipment.

G. Adequate Space Should Be Provided for Storage of All Types of Useful Materials and Equipment.

This would include:

1. Separate storage spaces for chemicals apart from that of mechanical and electronic equipment. (Chemical fumes cause corrosion when stored together.)

2. Adequate storage of glassware and other fragile materials.

3. Storage of heavy and large equipment on lower shelves.

4. Adjustable shelves to fit the equipment or materials, or permanent shelves providing different heights and widths.

5. Space for storage of printed materials, books, filmstrips, charts, pictures and clippings, filmstrip models.

6. Space for storage of specialized equipment such as microscope cabinets, skeleton, and torso cabinets.

H. Facilities Should Include Display Space for Projects, Specimens, and Commercial Products.

Projects developed in science courses which may have been exhibited in science fair or junior academy activities are often of the quality that would merit that they be kept intact and used for instructional and motivational purposes.

Rock collections, life histories, representative phyla, models of processing plants, etc. provide excellent displays for instructional purposes.

Room design should consider:

1. The location of display cabinets and shelves

2. A glass enclosed corridor display space

3. A special display area in the nature of a museum

I. School Facilities for Science Should Provide for Safety of Pupils and Teachers.

Facilities for safety would include:

1. Laboratory rooms with more than one exit

2. Gas line installation according to building codes

3. First-aid kit

4. Shutoff valves for water and gas well-marked and located in a prominent place

5. Master switches for electrical circuits

6. Floors that are not slippery

7. Fire blanket and emergency shower in chemistry Laboratory

8. Fire extinguisher

J. Science Facilities Should Provide for the Use of Varied Types of Learning Activities and Permit All Appropriate Aids to Instruction.

This would include:

1. Rooms equipped with room darkening facilities

2. Appropriately placed electrical outlets for projection equipment

3. Chalk boards, bulletin boards, and chart areas

4. A library area provided with periodicals, books and study space

5. Student laboratory tables, demonstration tables, stools, or chairs, special project areas, etc.

K. Rooms for Science Instruction Should Be Attractive Places for Development of Student Attitudes and Habits As Well As Acquisition of Knowledge and Skills.

This would include:

1. The installation of plumbing and wiring around the wall or in the floor. The presence of pipes extending down from the ceiling obstructs vision, creates a boiler room appearance rather than a good laboratory appearance.

2. The proper use of colors on walls, ceilings, floors, and furniture

3. Proper design of the room and arrangement of furniture

4. The creation of a scientific atmosphere conducive to motivated interest in learning—aquaria, growing plants, live animals, projects and exhibits, bulletin board displays

L. In Planning Science Facilities the Ideas of Many Qualified Persons Should Be Utilized.

These would include:

1. The science teachers who are more cognizant of the functional aspects of the facilities

2. Principals and superintendents

3. Supervisors of instruction

4. Supervisors of building construction

5. Technically trained people in the community

6. Architects

7. State Supervisor of Science; Supervisor of School Building Construction

8. Representatives of equipment supply companies

9. Special consultants

Since there may be more than one acceptable plan, the responsibility still rests with the local authorities to select the plan and facilities which would best serve their needs.

This choice should be made in the light of best qualified opinion and free from pressure of vested interests. Certainly the science teachers and administrators who are to "live with" the planned facilities should have a prominent role in the planning.

"A special effort should be made to secure the advice of the local teachers of science provided they are well-informed as to modern teaching methods and trends in science facilities and provided they have made satisfactory progress in their methods of teaching and attitudes in keeping with the developments in science that are appropriate for high school instruction."[3]

Visits by the local school personnel to good science laboratories should be made before planning is completed.

M. Science Facilities Should Possess the Particular Characteristics and Specifications Which are Unique for a Science Department.

For example:

1. Acid resistant table tops
2. Acid resistant floors
3. Sink and waste lines which are chemically resistant
4. Hard top surface for physics tables
5. Provisions for use of charts, A-V equipment, fume hoods, electrical outlets, electrical power units, etc.

N. In Planning School Facilities, Consideration Should Be Given to Providing Some Desirable Science Facilities Which Supplement the Facilities Ordinarily Provided in the Classroom.

Some facilities that would enrich the science program are as follows:

1. Weather Station
2. Greenhouse
3. Museum
4. Planetarium
5. Observatory

O. Room Space Should Be Provided for Teacher Counseling, Checking Papers, Keeping Reports, etc.

A space in the project preparation room, separated from main room by glass wall or window where the teacher can check papers and still have overview of small group work in the laboratory, is considered desirable. In larger schools a suite of offices for science teachers should provide space for the above purposes and also research and development by the faculty members.

P. Plumbing or Electrical Facilities Should Be So Located That Easy Access for Repair or Replacement Is Possible.

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[3] Ibid. p. 7.

CHAPTER 2

SPECIAL FACILITIES FOR DIFFERENT COURSES

SPECIAL REQUIREMENTS FOR A BIOLOGY ROOM

Some special needs of the biology room: (Some of these would also be needed in general science.)

1. Aquarium and terrarium

2. Germinating beds and soil bins

3. Dust proof case for microscopes and other optical equipment

4. Torso and skeleton cabinets

5. Special display space for museum specimens, preserved animals and plants

6. Plant and animal growing area

7. Incubator, oven, and refrigerator

8. Towel and soap dispenser

9. Special individual lighting for microscope work as well as good overhead lighting. See Appendix B, "Check List for Teaching Biology."

SPECIAL REQUIREMENTS FOR THE CHEMISTRY ROOM

Facilities and equipment primarily for chemistry:

1. A fume hood or forced ventilation should be provided in the classroom. Additional forced ventilation should be located in the chemical storage and preparation room. It is also desirable to have an outside window located in the preparation room.

2. The chemical supply table, the preparation table, and the shelves and cabinets for large bottled chemicals should have a wooden ridge **surrounding** the table or shelf. The ridge should be high enough to provide a basin for ordinary amounts of spilled chemicals.

3. If gas is not available for burners, additional electric outlets and circuits are needed in the room.

4. A special case or shelf for glass tubing should be provided.

5. Space should be provided for stoneware receptacles throughout the classroom and preparation room. These jars should be easily accessible but not in the line of traffic.

6. All painted surfaces in the room, the sinks, sewer lines, floors, and working surfaces should be of materials resistant to corrosion, tarnish, and moisture damage.

7. A convenient place should be planned for a water still and/or a dispenser table or stand for distilled water.

8. Special storage facilities, located at the floor level, should be provided for large bottles of liquid chemicals. These shelves should have a small ridge surrounding them to hold spilled chemicals.

9. At least one metal-lined cabinet should be provided for highly volatile chemicals.

10. Plan for storage area for tote trays, if they are to be used. Special cases under the wall counters are convenient for storing tote trays as these cases can be spread over a distance and thus reduce the congestion in getting and returning the trays.

11. Plan a convenient location for the reagent case and a balance table.

12. Traffic control in a room where chemicals are handled is of utmost importance. Special consideration should be given to the planning of traffic lanes to and from the (1) supply table, (2) reagent case, (3) balance table, (4) fume hood, (5) tote tray cabinet and (6) preparation room to reduce hazards and to make for a smooth flow of traffic.

13. Science rooms in which students are to use chemicals should be designed so as to eliminate as many blind corners as possible. This may be accomplished through the proper location of cabinets and doors, vision panels in doors and vision strips between the classroom, storage rooms, and preparation rooms.

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[4] DeH. Hurd, Paul, "The Modern Science Room," **Science Facilities for the Modern High School**, Ch. 5, Monograph No. 2, School of Education, Stanford University, Stanford University Press, pp. 32 and 41.

Additional suggestions:

Poisonous chemicals should be under lock.

A fire extinguisher and safety shower would be most essential in case of an accident.

A fume hood is regarded as absolutely essential.

See Appendix C, "Check List for Teaching Chemistry."

REQUIREMENTS FOR PHYSICS

Experiments by students:[5]

> In strong physics courses, the teachers place considerable emphasis on student experiments. Students work individually or in pairs, or—less desirably—in groups of more than two. They use physics apparatus, exploring the physical world in a variety of experiments in the sub-areas of physics such as mechanics, wave motion, sound, heat, electricity and magnetism, light and atomic and nuclear physics. Students may investigate wave phenomena, measure the velocity of light, or count particles from a radioactive source. Direct contact with the apparatus and opportunities for the student to show initiative, ingenuity, and persistence in his experimental work are most important. The laboratory class—usually a group of about 24 students—ideally meets once or twice a week for a double period. Although single-period laboratory sessions are prevalent, many schools at present are attempting to replace them by double-period laboratory sessions. A 40-or 45-minute span of time is just not long enough for the class to set up its apparatus, carry on reasonably coherent experimental work, and put the laboratory in order for the next class. Laboratory classes with more than 24 students are feasible. To conduct them effectively, however, the physics teacher needs a qualified laboratory assistant, and the school must, of course, make a greater investment in laboratory equipment.
>
> Experiments by the physics class are carried out on broad sturdy laboratory tables, or wall benches, provided with durable surfaces and supplied with the necessary services. Some physics equipment is heavy, and much of it requires a stable support so that shaking or jarring the table will not disturb the adjustment of the apparatus. For both reasons, laboratory tables must be strongly built with adequate cross-bracing. Table drawers are usually not wanted since they are seldom used for apparatus storage and often become depositories for broken wires, waste paper, and dust. Physics students sometimes stand, sometimes sit, at their laboratory work depending upon the task of the moment. Hence a convenient table height—usually about 30 inches—is necessary for standing without excessive bending and for sitting on chairs with knees clearing the lower edge of the table.
>
> Overhang of the table top of not less than 2½ inches provides needed room for table clamps that support rods and apparatus. Tapered or threaded sockets for rods are also often provided in the table top. Wood is the preferred material for physics tables: it is non-magnetic, electrically non-conducting, more quiet than metal, does not dent readily, and resists thermal shock. Solid maple table tops sealed with clear lacquer provides good service. Corrosive chemicals, apart from battery liquids, are seldom used in physics classes. A variety of non-corrosive liquids can be spilled on the table during experiments, however, and the table top should be designed accordingly. The handlings of mercury by students is not recommended except under extremely careful supervision because spillage creates an accumulating health hazard and is expensive. Heat experiments in schools seldom require raising the temperature of objects beyond the boiling point of water. Hence, an asbestos pad placed underneath burners, heaters, and containers of hot water usually provides sufficient thermal protection for the table top.
>
> About 7 square feet of table top should be provided for each experimenter. Physics experiments often involve apparatus that spreads out over the table such as tracks, trays, electrical meters and their connecting wires, supporting rods, and swinging pendulums. Ample apparatus room and elbow room should be provided. The top of the table should be kept as free of obstructions as possible. Gas cocks and electrical terminals might well be

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[5] Palmer, R. Ronald and William M. Rice. **Laboratories and Classrooms for High School Physics.** A Report of the American Institute of Physics Project on Design of Physics Buildings, Educational Facilities Laboratories. Reinhold Publishing Company (1961), pp. 7-10.

mounted on the side of the table or, if this is not possible, in compact groups near the center of the table. Incidentally, provide ample storage space against one wall of the laboratory for notebooks and textbooks that are not needed during the laboratory work so that they will not add to the clutter on the table. Hooks in the ceiling above the tables are used in some schools for mounting student apparatus.

The services most often required at student tables are gas and alternating current at 120 volts. Currents required at each outlet seldom exceed 5 amperes. At least four convenience outlets for AC and at least one gas connection should be provided for each pair of students. Taps for hot and cold water should be provided at sinks with suitable splashboards, at least two sinks to a laboratory. Direct-current services at several voltages—usually 6, 30, and 120—are needed to varying extents depending upon the level of the physics course. Small direct currents are provided by dry cells, and steady direct current at 6 volts by batteries placed on or near the tables. The higher direct voltages, depending upon the degree of regulation and the power required, are usually supplied by motor-generator sets or rectifier banks. The outputs of these central installations are distributed by panel boards controlled by the teacher or by smaller local power supplies at the students' tables. Central power systems properly designed and installed, are versatile, are centrally controllable by the teacher, and generally require a sizable initial investment. However, some teachers prefer local power supplies. While considering the installation of a central switchboard, school planners should look very carefully at the requirements of the school and at the relative advantages and disadvantages to the school of central versus local power supplies with reference to regulation under load, intitial costs and maintenance costs, versatility, and student and teacher acceptance of the devices. Some other laboratory services provided in more advanced physics laboratories, or project areas in the larger high schools are 6.3 volts ac, rough vacuum lines, and compressed air lines. A good electrical connection to wet ground is useful within the laboratory. If the school has a radio club, conduits from the classroom to the roof will be required for antenna wires. Chemical hoods with exhaust fans are seldom needed in physics laboratories. Students who need them occasionally for projects can usually obtain access to them in chemistry laboratories.

See Appendix D, "Check List For Teaching Physics."

SPECIAL REQUIREMENTS FOR GENERAL SCIENCE

(Junior High, Grades 7, 8, 9)

The junior high or general science room requirements are unique to the grade level, but in any case the **room** must be **larger** than usual size classrooms, if it is to serve adequately for science instruction. A room overcrowded with chairs and students cannot possibly provide for all the essential activities.

1. Fixed wall counter tables and movable center room tables seem to provide the flexibility needed for general science.

2. Gas and water are needed and electrical outlets should be provided in the backsplash of the wall counter tables, or in service islands.

3. Special provisions should be made for areas for the keeping and growing of plants and animals. This would necessitate aquaria, terraria, animal cages, germination boxes, etc. Table space and microscopes should be provided for microscopic work.

4. Special provisions should be made for earth and space science instruction such as rock and mineral collections, planetarium, telescopes and weather equipment.

5. Special table space is needed for the construction of home-made equipment, the repair of commercial equipment, the preparations of collections, etc.

6. Display cabinets at this age level are especially significant. These are used for student projects, collections, and commercial products.

7. Special study area equipped with books, bookshelves, table, magazine racks, and charts, is a valuable feature to a junior high science room.

All of the current literature dealing with Junior High Science emphasizes the necessity for laboratory activities on the part of Junior High students, not only the 9th grade, but 7th and 8th grades as well. This demands more than the science demonstration desk. Work spaces for students in a class situation should be provided.

A statement from the **Illinois Journal of Education** (November 1961) follows:

"An inspection of the physical facilities of a modern junior high school indicates that the trend toward making seventh and eighth grade science a laboratory course has progressed beyond the point of just being a trend. Many of our schools today have as complete and functional laboratories as we would have found in the senior high schools of a decade ago. Some of these are equipped with all the common services(gas, water, and electricity) formerly found only in senior high school labs. Fundamental pieces of equipment in multiples sufficient to allow individuals or small groups to perform experiments are being provided."

SPECIAL REQUIREMENTS FOR PHYSICAL SCIENCE SURVEY COURSE

A lecture-laboratory room equipped for the teaching of both chemistry and physics will serve fairly adequately for the general physical science course. However, if some earth science is included, then facilities for this phase must receive attention.

See Appendix A, "A Check List of Facilities For Teaching General Science in Grades 7, 8, 9."

TEACHABLENESS[6]

A teachable room is one which expedites and facilitates the learning activities defined by the purposes and objectives of the course. A teachable room includes physical facilities which aid rather than hinder teaching and learning processes. In these terms the following features would be essential in a good classroom.

1. The room has the teaching aids located so that they are conveniently accessible (roll-down projection screens, demonstration supplies convenient to the demonstration table, etc.)
2. The room is easy for the teacher to move around in so as to work with individual or small group of students.
3. The arrangement of equipment makes it easy to shift from one teaching activity to another (discussions to laboratory work to projected materials, for example, without serious loss of time or confusion.)
4. The room should be so designed as to make possible a wide range of student activities to take place simultaneously.
5. There should be such auxiliary storage, preparation, and project rooms (or the equivalent in facilities) that make it possible for the teacher to prepare adequately for and to handle several different science classes in sequence.

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[6] DeH. Hurd, "Factors Basic to the Development of Adequate Science Facilities." Ch. 4, op. cit., p. 26.

CHAPTER 3

GENERAL STANDARDS LABORATORY FURNISHINGS

Basic Considerations:

1. Furniture and equipment of average quality or above will likely prove most satisfactory, usable, and most economical. If the budget does not permit complete furnishings of the science department in one year, quality standards may still be maintained by adding pieces of furniture as budget will permit.

2. The furniture most suitable for the department will depend upon several factors—chief among which would be the consideration of the different areas of science to be served. What subjects will be taught in the particular room in question?

3. If the room is to serve both as a classroom and a laboratory, then the proper selection of equipment in consideration of space is an even more acute problem.

4. Furniture should be selected which is durably built from well-seasoned or kiln dried lumber and all working surface should be specially designed and equipped for the sciences to be taught.

While there is a lack of unanimity of opinion on the best design of laboratory furniture, there are some points of general consensus on student tables. Some of these points of agreement are as follows:

1. Where all sciences (biology, chemistry, and physics) are to be taught in the same laboratory, the student table should be equipped with water, gas, and electrical outlets, a center sink, drawers for storage space, acid resistant top, and serving from 2 to 8 students.

2. Where laboratory is used for biology only, the table may or may not be provided with utilities, but a sufficient number of sinks, gas, water, and electrical outlets should be available in the room. Electrical outlets either on the student tables or wall counter tables are essential for microscope work. The two-student tables, 24, to 30 inches wide, are preferred to the longer eight-student tables, but the same 15 two-student tables required for 30 students may be more expensive. If general science is taught in the room with biology, then gas and electrical outlets are still more essential.

3. Where the laboratory is to serve for physics only, the table should be very durably built, equipped with gas and electrical outlets, and should have vertical and horizontal rods, and a hard top surface. Power supply units installed in the tables, or general distribution panels should be considered.

4. Where the laboratory is to serve for chemistry only, it is obvious that acid resistant drains, acid resistant table surfaces, electricity, water, and gas connections, reagent space, and storage drawers should be provided. The cup type sinks are preferred to center trough draining into end sink.

5. Facilities for general science in the junior high division, 7th, 8th, and 9th grade, should be adequate to the teaching of general science. Facilities should include: tables, storage and display units, utilities consisting of gas, and water and electricity for student demonstration and experimentation as well as for teacher demonstrations.

"Basic considerations" listed above are found also in Mississippi School Bulletin No. 150, Title III, NDEA, Handbook for School Administrations (Sept. 1961).

LABORATORY FURNISHINGS-SECONDARY SCHOOL SCIENCE

Description of the item indicates desirable qualities (specifications which should be sought in selection of laboratory furniture).

Name of Facility	and Description of Facility
Aquarium tank	20-50 gallon, permanent type installation, heavy glass and stone with metal rod supports and air supply outfit.
Blackout equipment	Opaque shades, blinds, curtains.
Boxes	Window boxes.
Cases: Display	Cases suitable for collections, taxidermy mounts, projects of special scientific interest.

Storage	Adjustable shelves, glass or wooden door; or shelf, rack and drawer combination.
Cabinets: Storage	Different size compartments fitted to equipment, such as, microscope cabinet, chemicals, etc.
Demonstration desk	Utility connections; acid resistant top; water, gas, and electrical outlets. All rooms where science is taught should be equipped with a demonstration desk. If not permanently equipped, a portable desk (portable laboratory on wheels) should be provided with acid resistant top, sink and water source, and electrical outlets.
Laboratory fume hood	Powered by at least ⅛ horsepower AC motor, acid proof work area, gas and electrical outlets available.
Racks, display, storage	For storage of charts or display of magazines.
Sink	Wall installation (cabinet type) acid resistant construction and plumbing.
Stools	Durably built, rubber capped legs, height to match table.
Student laboratory tables	All tables should have acid resistant top, should be durably built, non warping, with drawers and doors easily operated. Five or more square ft. of table area per student should be provided on table surface.
General purpose tables	Equipped with water, gas, electricity, and sink.
Biology tables	May or may not have water, gas, electrical connection with sink on the tables but all utilities should be provided in the room. Where tables are not equipped, it is recommended that the room provide 4 to 6 water and sink units, 12 to 15 electrical outlets (for microscope lamps and other purposes) 6 or more gas outlets.
Physics tables	Very hard top finish, strong and durable, vertical and horizontal bars, gas and electrical connections.
Chemistry tables	Tops very acid resistant non-corrosive sinks or drains, equipped with water, gas and electrical connections, and storage drawers or cabinets.
Junior High general science tables	Refer to "General Purpose" specifications or description in General Standards Laboratory Furnishings Page 24, Secondary Science, Title III, NDEA List.
Service Island When tables are not equipped	Equipped with gas, electrical and water connections—acid resistant sink.
Germinating bed	Durably built, drain facilities, casters preferred.
Terrarium	Durably built, glass doors or windows.
Wall counter tables—Importance dependent upon tables and other furniture in room	Cabinet type, acid resistant top, (should provide sufficient electrical outlets, sinks, water and gas connections in part or all of the units.)
Electrical power supply power unit	Low voltage AC and DC. Variable AC and variable DC, with circuit breaker, 5 or more amp. capacity. For special electronic equipment, higher voltage units should be acquired according to the demands of the application.
*Bulletin boards	
*Chalk boards	Sliding, multiple boards which may also provide some storage area should be considered. This may be mounted as to constitute a movable wall between laboratory room and storage room.
Laboratory cart	A portable unit with plane top and one or more shelves, large casters.
*Book shelves or bookcase and study table, if room size permits	
Microscope case	Containing 15 or more compartments
*Periodical display rack	
Preparation or projects room wall counter unit	Sink, acid resistant top, storage space, equipped with water, gas, and electricity.
Darkroom table	Acid resistant top, sink, storage drawers or cabinets, equipped with gas, water, and electricity.
Reagent shelves	Open shelving.
*Notebook cases	
*Key cases	
Wall screen	60" by 60" or approximate size, mounted on brackets, spring roller.
Chart racks	May be wall mounted for spring rolier charts.
*Towel and soap dispensers	

The above items and similar specification are also listed in Mississippi School Bulletin No. 150 (Title III, NDEA), with the exception of those marked with an asterisk.

CHAPTER 4

REMODELING THE SCIENCE LABORATORY

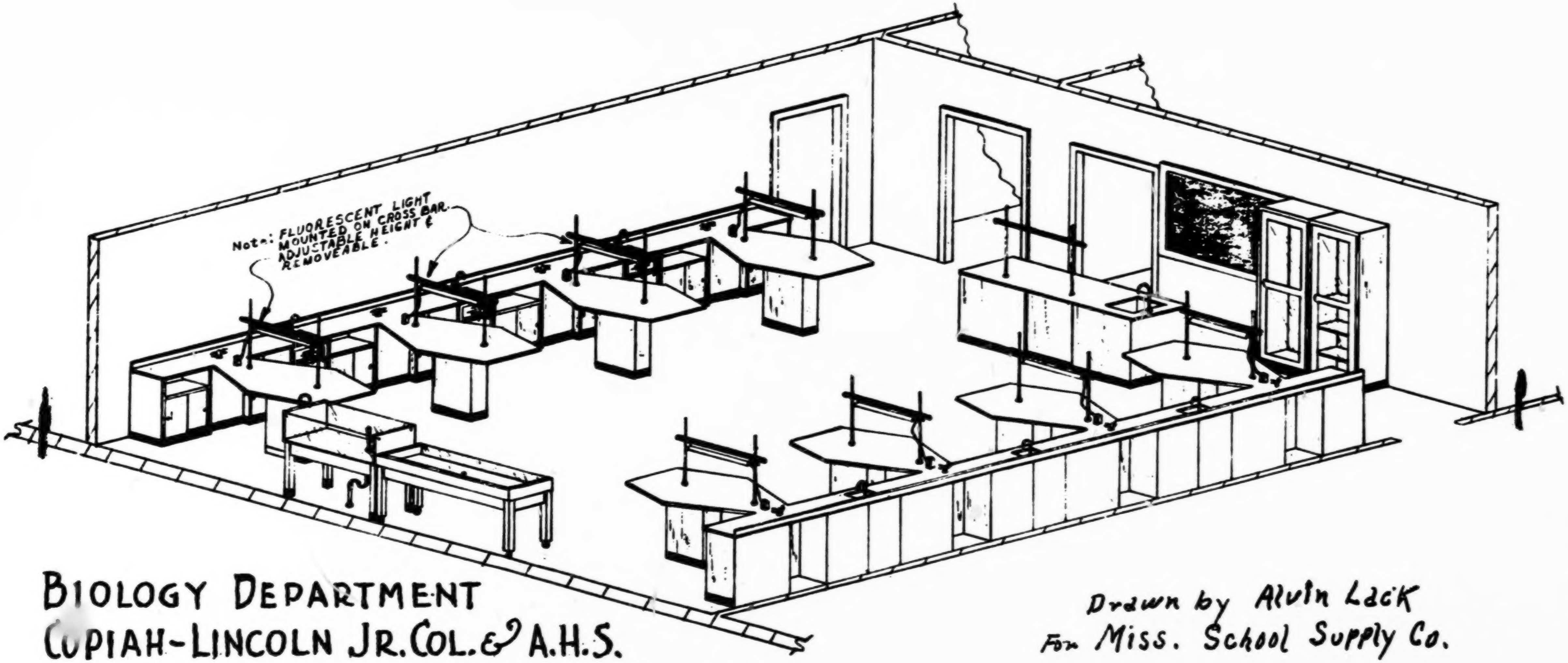
In some cases, existing facilities may be converted into much improved teaching space through remodeling. Three adjacent classrooms end to end may be made into two combined laboratory classrooms through the removal of two walls and the construction of storage and preparation rooms between the two new rooms.

Plumbing facilities may be installed for student tables, instructors' desks, sink units, gas outlets or fume hoods. This is a comparatively simple process through wood floors. If the floors are concrete then special precautions should be observed in regard to safety features with respect to gas installation. Local gas companies likely can advise on the matter. For natural gas installation, information can be obtained from **Southern Building Code,** a guide which may be available through the local gas company.

For liquid gas installation, check with the L. P. Gas Division of the State Motor Vehicle Comptroller Office.

Frequently there is an urgent need for more storage space. It may be possible to convert adjacent utility rooms to storage rooms. In some cases, a wall may be removed to enlarge the teaching space and a storage room constructed in the new addition. Separate storage rooms for chemicals apart from electronic and mechanical equipment are very desirable.

In considering the annexation of storage space one may consider also the possibility of solving the problem through acquiring storage cabinets, wall counter tables with storage space, or new student tables fully equipped with storage compartments.

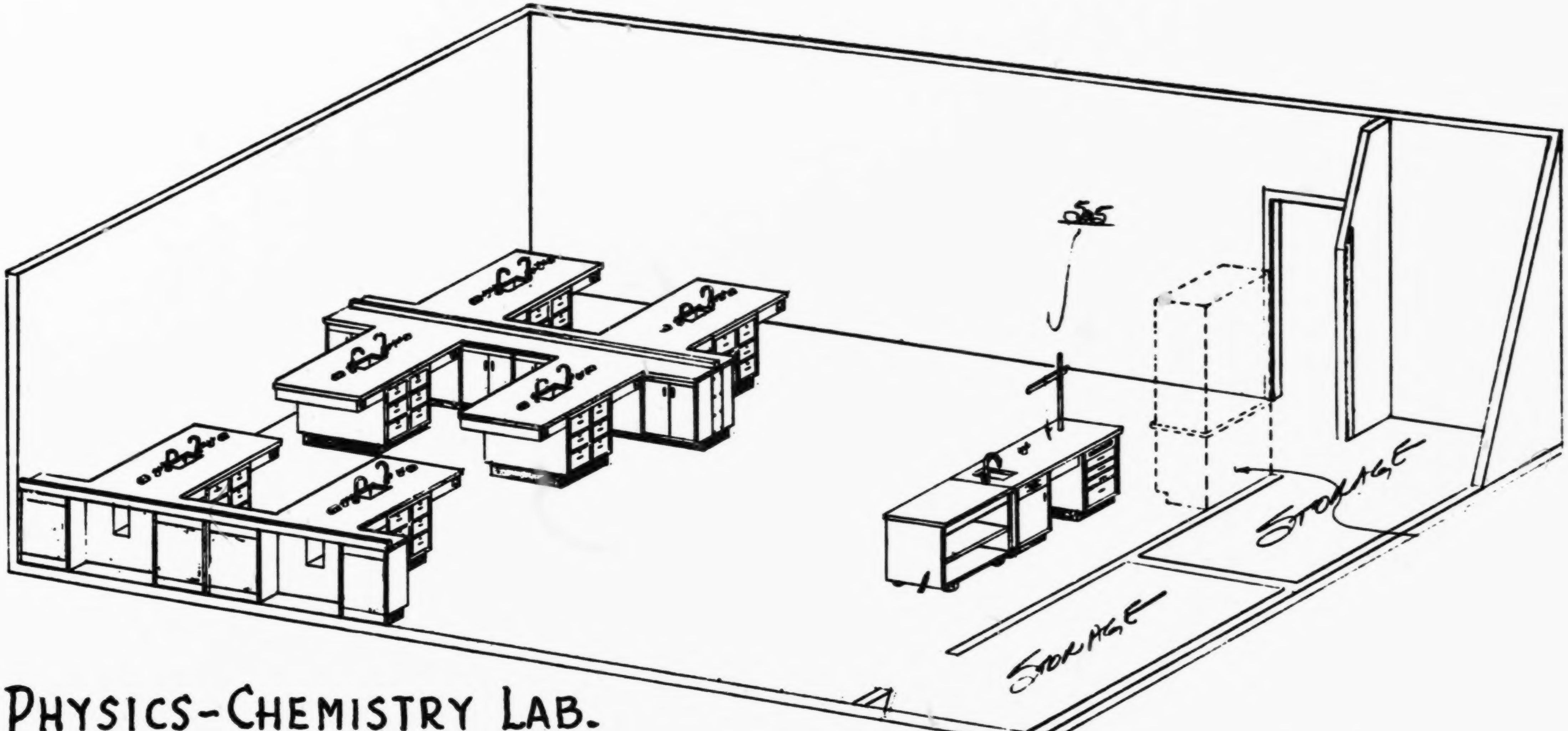

Note: FLUORESCENT LIGHT MOUNTED ON CROSS BAR. ADJUSTABLE HEIGHT & REMOVEABLE.

BIOLOGY DEPARTMENT
COPIAH-LINCOLN JR. COL. & A.H.S.

Drawn by Alvin Lack
For Miss. School Supply Co.

Remodeling at Copiah-Lincoln Junior College and AHS

A thorough remodeling and renovation was done in the Biology Department at Copiah-Lincoln Junior College and AHS. The accompanying sketch shows the room appearance and arrangements after remodeling. Tables are arranged around the wall since plumbing and wiring can be provided much more economically in this arrangement than through the floor. The concrete floor was covered with new concrete and then covered with tile. Large storage rooms and project areas open near the demonstration desk.



PHYSICS-CHEMISTRY LAB.
CANTON HIGH SCHOOL

GENERAL EQUIPMENT MANUFACTURERS

Remodeling at Canton High School

Installation of plumbing and wiring through a wooden floor made possible the equipping of a physics-chemistry room with modern student tables.

Through the construction of a partition in the old science room, storage space was created.

A fume hood and display cases, not shown in diagram, were added.

The tables were equipped with lab-volt units in addition to water and gas facilities. Chair area is at the front of the room.

At the same building two adjacent classrooms were converted into a large biology-general science room by removing a partition and constructing storage space at the end of the new room. This room, too, was equipped with new student tables, demonstration desk, aquarium, germinating bed, a corridor display and other units in modernizing this part of the science department.

CHAPTER 5

AUDIO-VISUAL FACILITIES FOR SECONDARY SCIENCE TEACHING

Special attention should be given to audio-visual facilities in the initial planning stages. Facilities may be considered in the categories of projection facilities and non-projection facilities.

NON-PROJECTION FACILITIES

In the non-projection classification, we consider models, charts, mounted and preserved specimens, museum specimens, a continued experiment, pictures, factory or commercial products and student projects; these facilities require space for display.

Glass enclosed display cases may serve part of the need. Further display space may be provided by proper size shelves. A wall display visible from the corridor motivates both the exhibitors and the observers. Attractive displays are continuous centers of interest and learning, and they should be well lighted.

Shelves and ledges may be provided for displays of mounted specimens. Cork boards may be installed for displaying pictures, posters or mounted plants. A tack board should be installed at eye level, located where it is easily visible to students. Avoid glare from windows and other sources of light.

Charts may be acquired in a set which are mounted on rollers in a rack attached by brackets above the chalk board. If the wall mounted charts are not provided, then charts on a roller base would be preferred to the tripod non-roller type.

A filing cabinet should be provided for clippings, pictures, bulletins, charts and other printed materials useful to science instruction.

PROJECTION FACILITIES

The use of projected material involves special attention in planning since projection requires special provisions. The problem of projection includes the important consideration of darkening facilities, electrical outlets, screens, and ventilation.

Electrical outlets are essential, and should be provided at the front and rear of the room in addition to other outlets. Room may be effectively darkened through the use of roller shades, drapes, or venetian blinds. Venetian blinds of special design and installation may do effective darkening and at the same time harmonize with colors in the room.

A wall-mounted screen 60 inches to 70 inches in width and length is most satisfactory. This roller screen may be mounted on brackets above the chalk board where it is readily pulled down for use.

Proper ventilation of a well-darkened room is rather difficult. Some ventilation is afforded through the use of venetian blinds. More ventilation may be obtained through the use of drapes suspended from a track at the ceiling, at a distance of about one foot from the windows and two feet from the floor; however, equipment about windows in some science rooms may present obstructions to the use of drapes.

Where projection equipment is readily available in the science room or in the department, both effective and efficient use can be made of the equipment. It is assumed that through the matching funds of NDEA practically all schools have attained this standard.

In most cases a projection stand with projectors should be in the back of the room and ready for use with a minute's preparation. Operating troubles are kept at a minimum when only one or two persons operate and handle the particular projector.

Mississippi School Bulletin No. 150 (Title III, NDEA) lists projectors and minimum specifications.

Projection equipment most often used for secondary science are motion projector, film and slide projector, microprojector and overhead projector. The latter has a great potential for science instruction yet has not attained the full measure of its potentiality. This may be due to lack of materials or acquaintance with the machine. Care should be given to the selection of projectors considering, ease of operation, lamp brilliance, maintenance service, cooling system, and many other factors.

Record players and tape recorders are finding more use for science. Records are now available on bird songs and call notes, frog voices, insect sounds, and so on. Some scientific lecturers or other programs are on disc.

Tape recorders may be effectively used through recording TV or radio programs and reproducing these in the classroom. Schools located in areas where there are educational TV or radio stations have a great advantage in this regard.

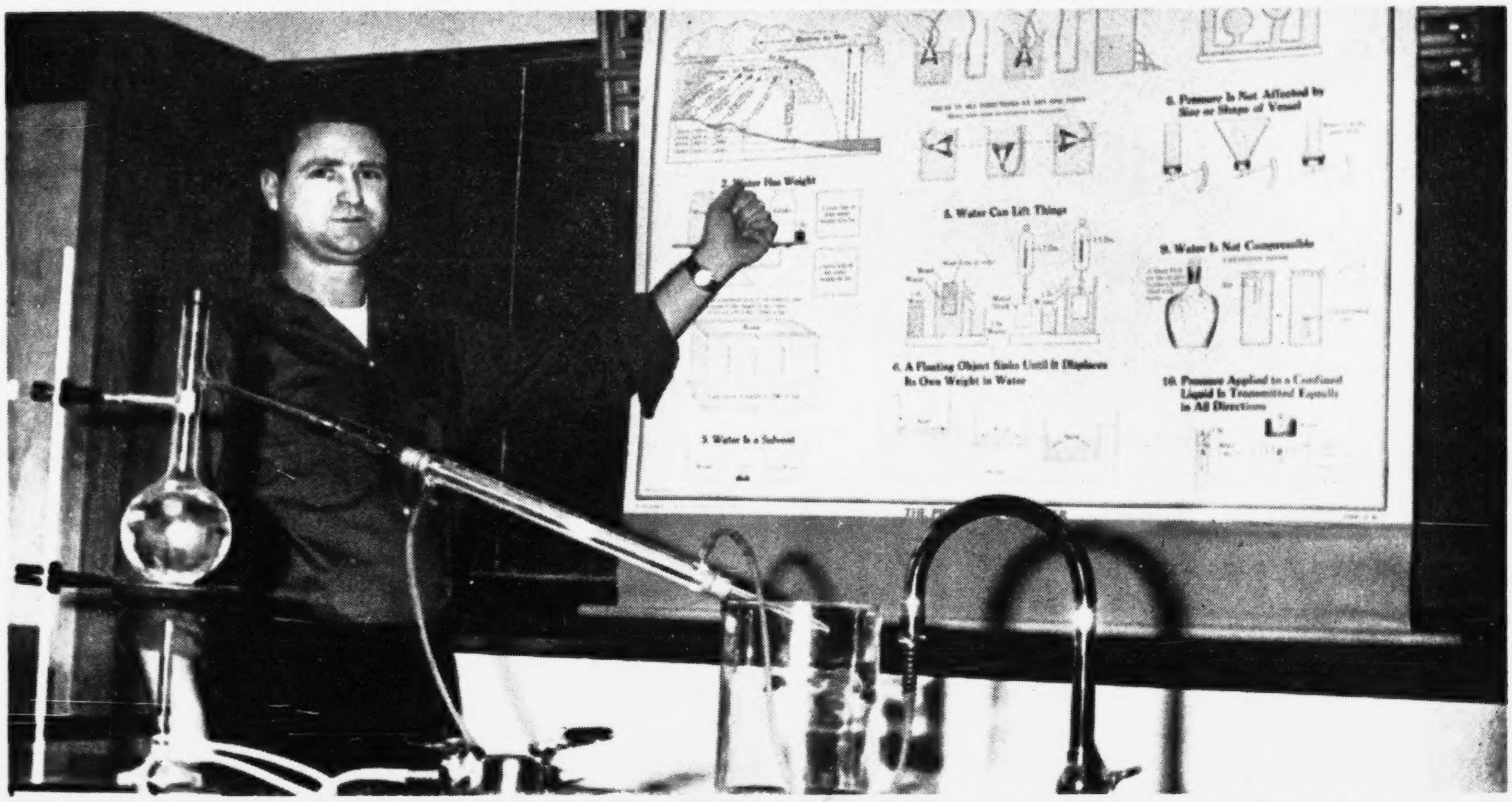
Further discussion on audio-visual facilities is given in Chapter 2 of Part II.

CHAPTER 6

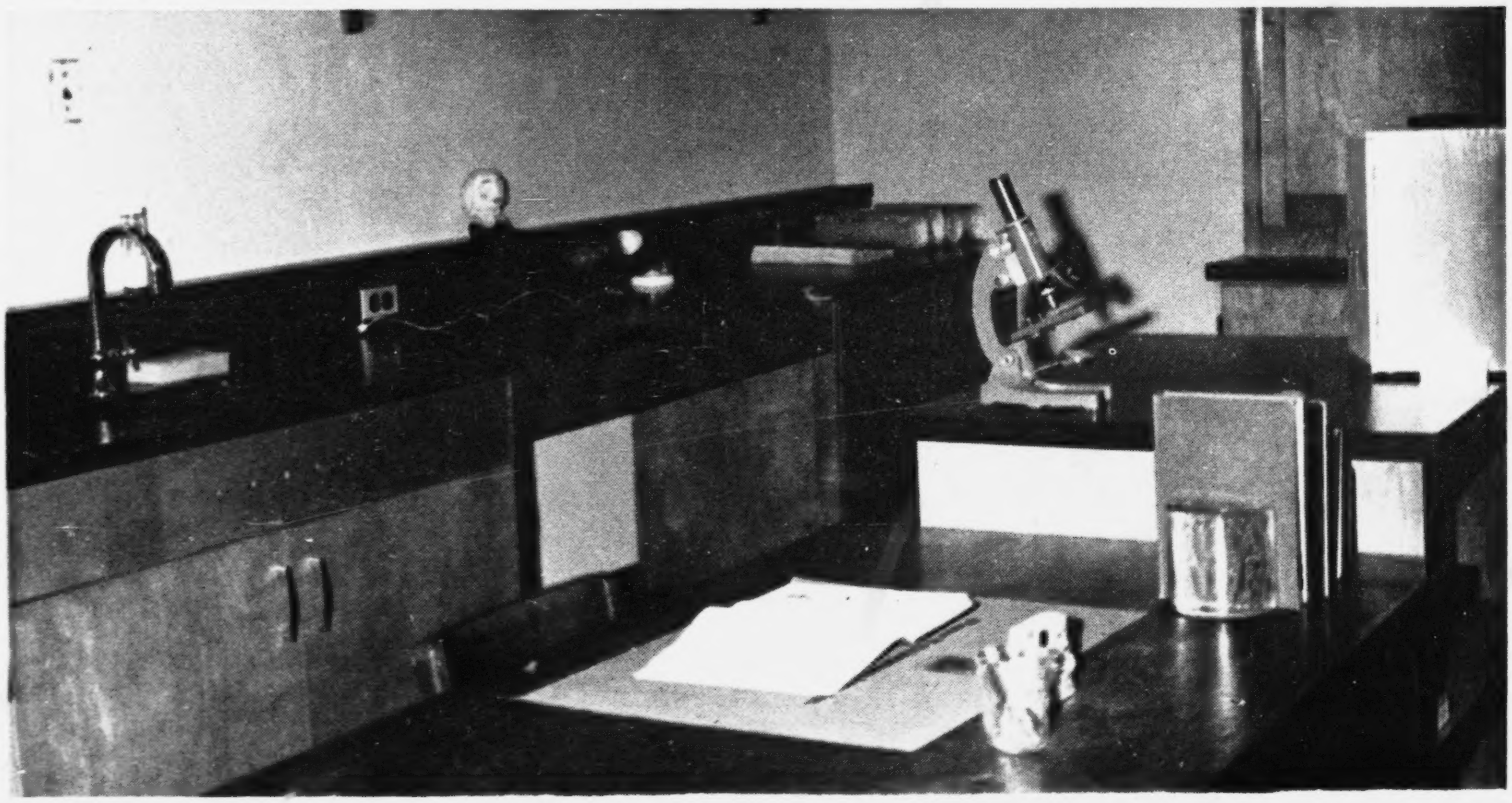
PHOTOGRAPHS OF HIGH SCHOOL LABORATORIES IN MISSISSIPPI

GREENWOOD JUNIOR HIGH SCHOOL

Greenwood, Miss.


5. Water Can Lift Things
6. A Floating Object Sinks Until It Displaces Its Own Weight in Water
8. Pressure Is Not Affected by Size or Shape of Vessel
9. Water Is Not Compressible
10. Pressure Applied to a Confined Liquid Is Transmitted Equally in All Directions
3. Water Is a Solvent

Note the spring roller charts mounted in rack. The room is equipped with installed wall counter tables providing water, gas and electricity as well as the teacher's demonstration desk as shown in photograph.



Another science room at the same school. Note the wall counter work table with storage. All science rooms at the school underwent remodeling to provide work spaces for total laboratory classes. Utility table and laboratory cart are in the foreground. Teacher's demonstration desk is at the other end of room.

LEXINGTON HIGH SCHOOL

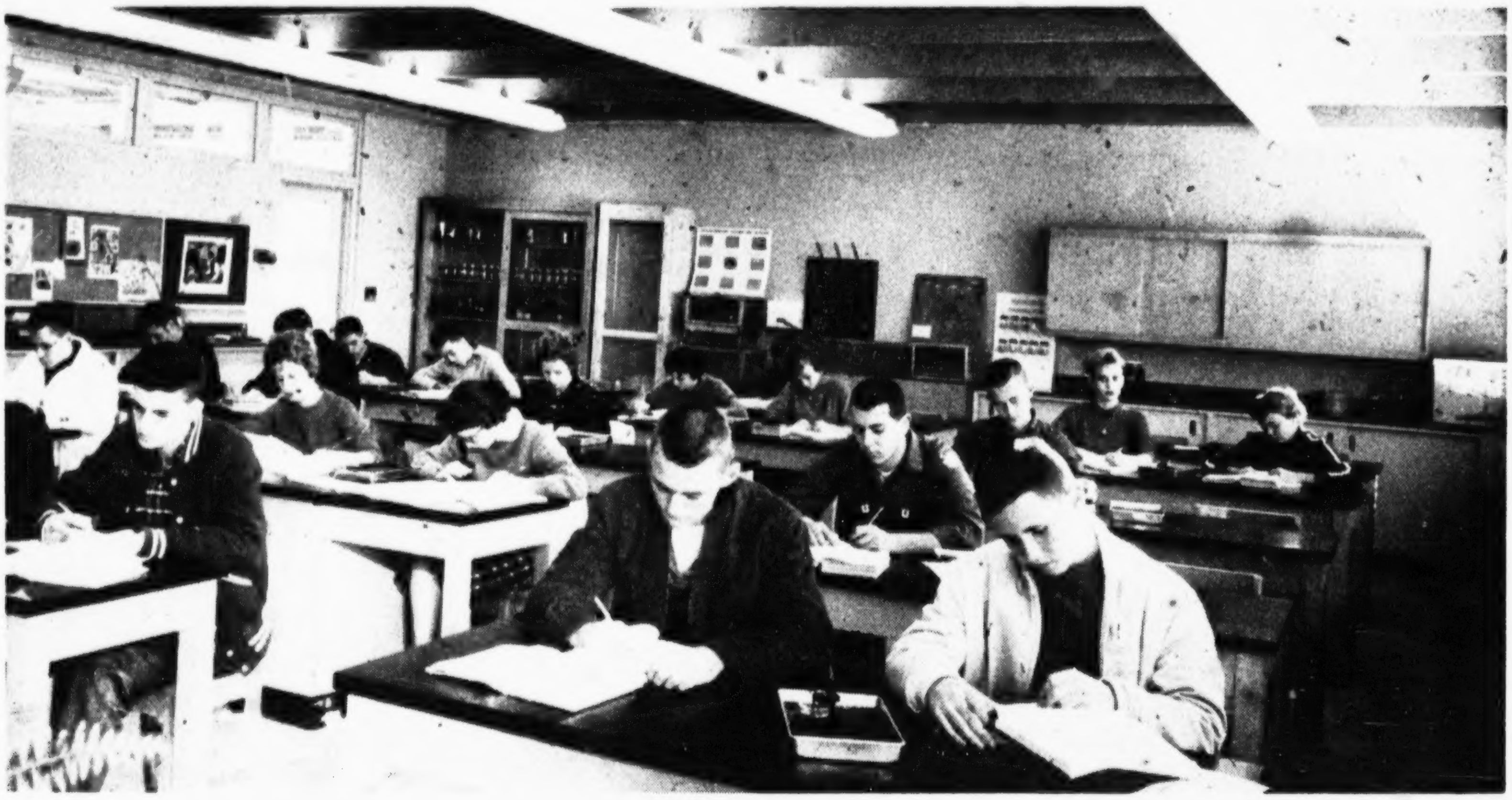
Lexington, Miss.

Good lighting as shown here is most essential for microscope work. Shielding of light fixtures no doubt has been provided.

Fume hood and wall counter sink unit.

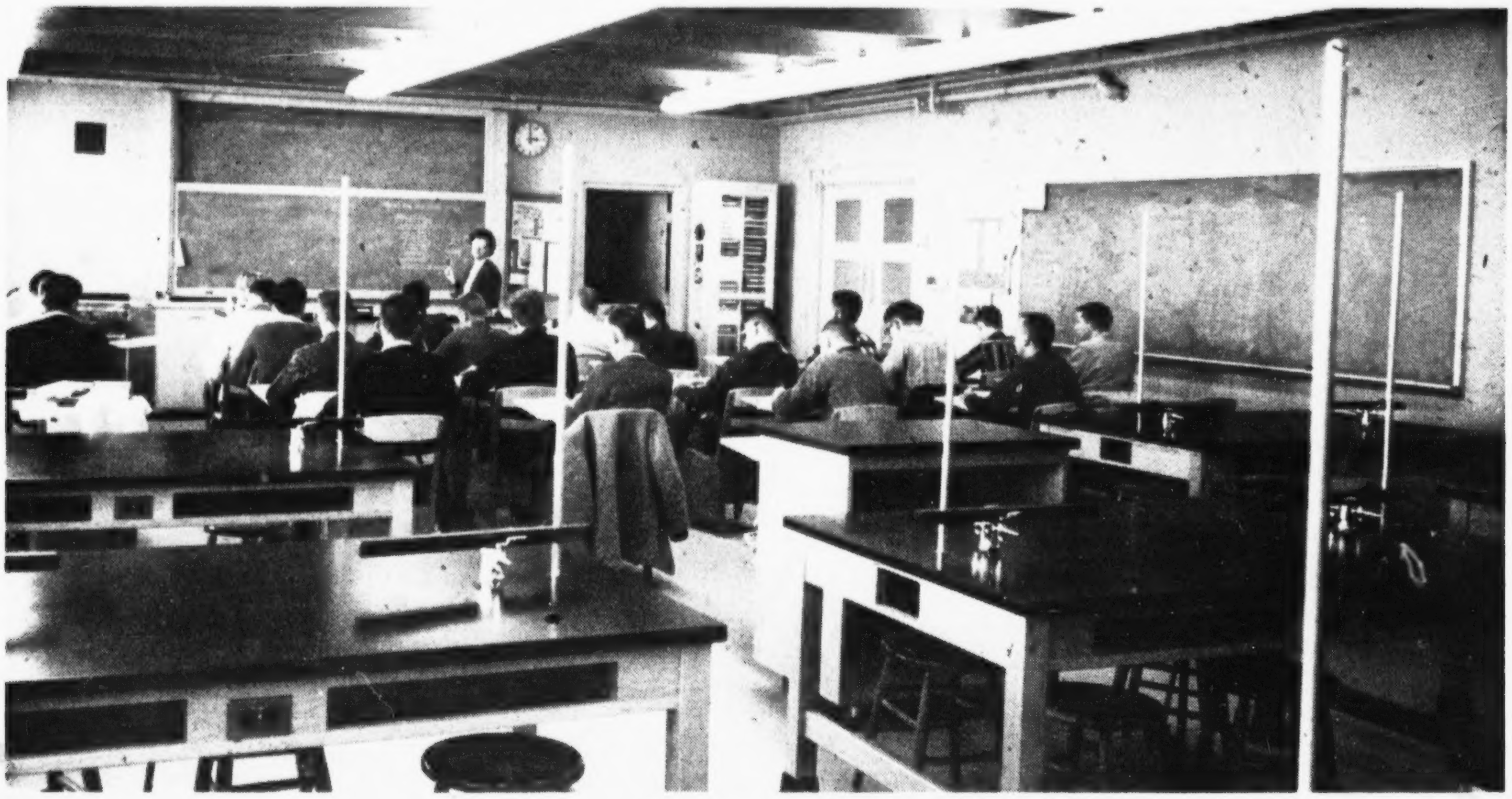
GULFPORT HIGH SCHOOL

Gulfport, Miss.



BIOLOGY ROOM

One of the two biology rooms connected by a projects room with large aquarium and other equipment. Equipment is readily accessible from the large storage area between the two rooms or from the wall counter storage units.

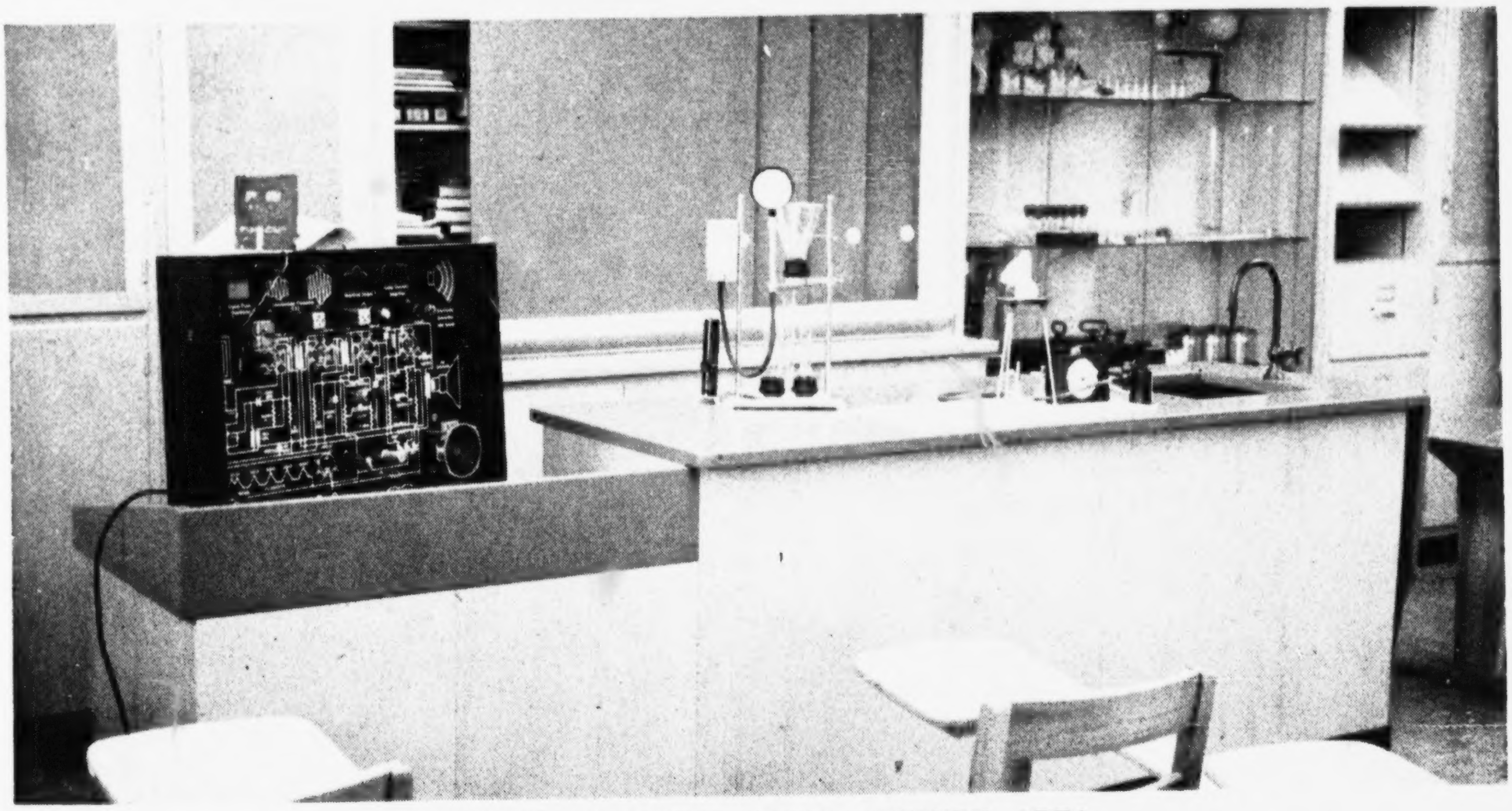


PHYSICS ROOM

Tables here each provide for four students. There are book recesses for each student in the table. Chalk board is on the side as well as the front for problem work and drawings required in physics.

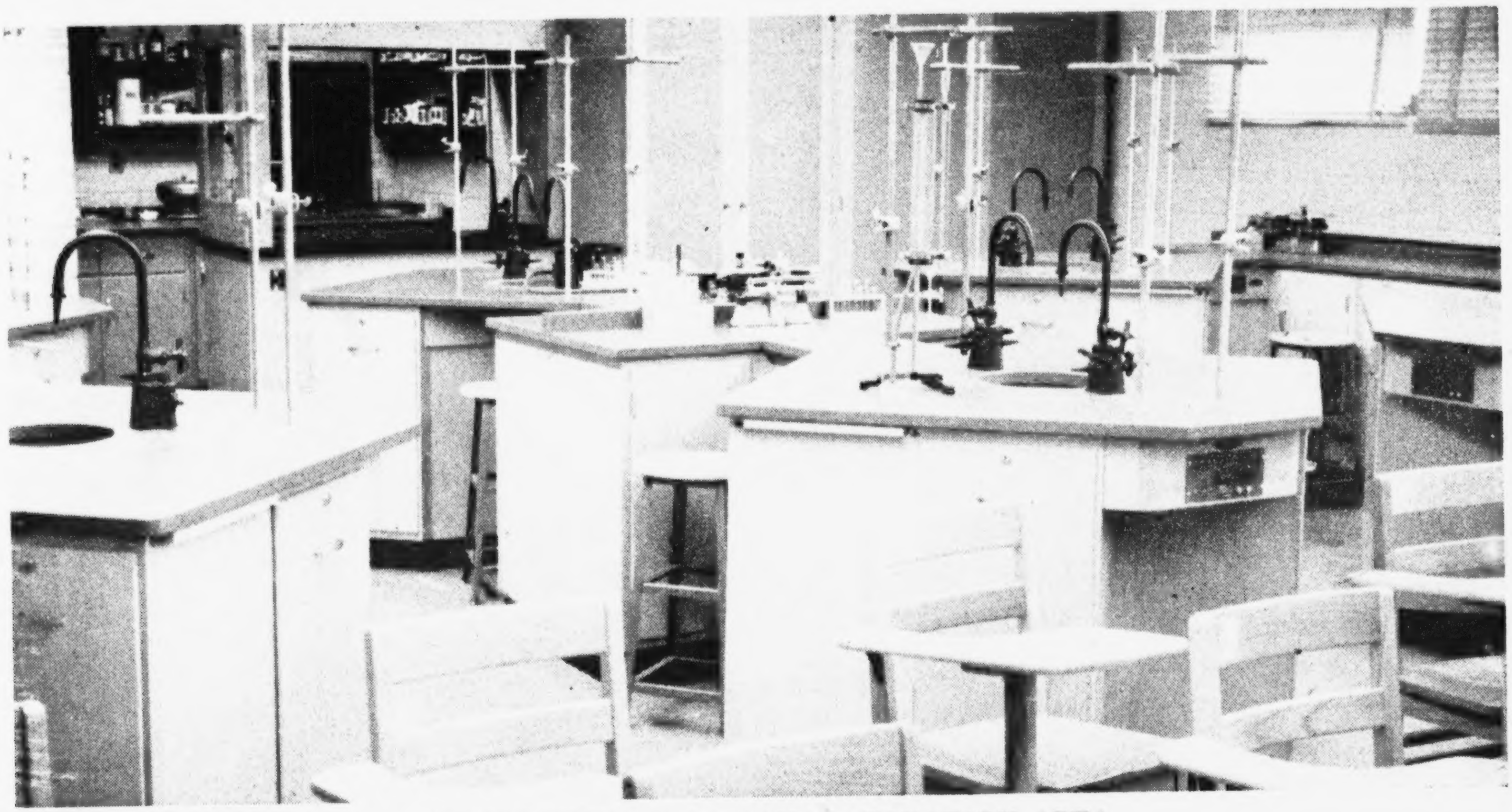
PHILADELPHIA HIGH SCHOOL

Philadelphia, Mississippi



PHYSICS-CHEMISTRY ROOM—LECTURE AREA

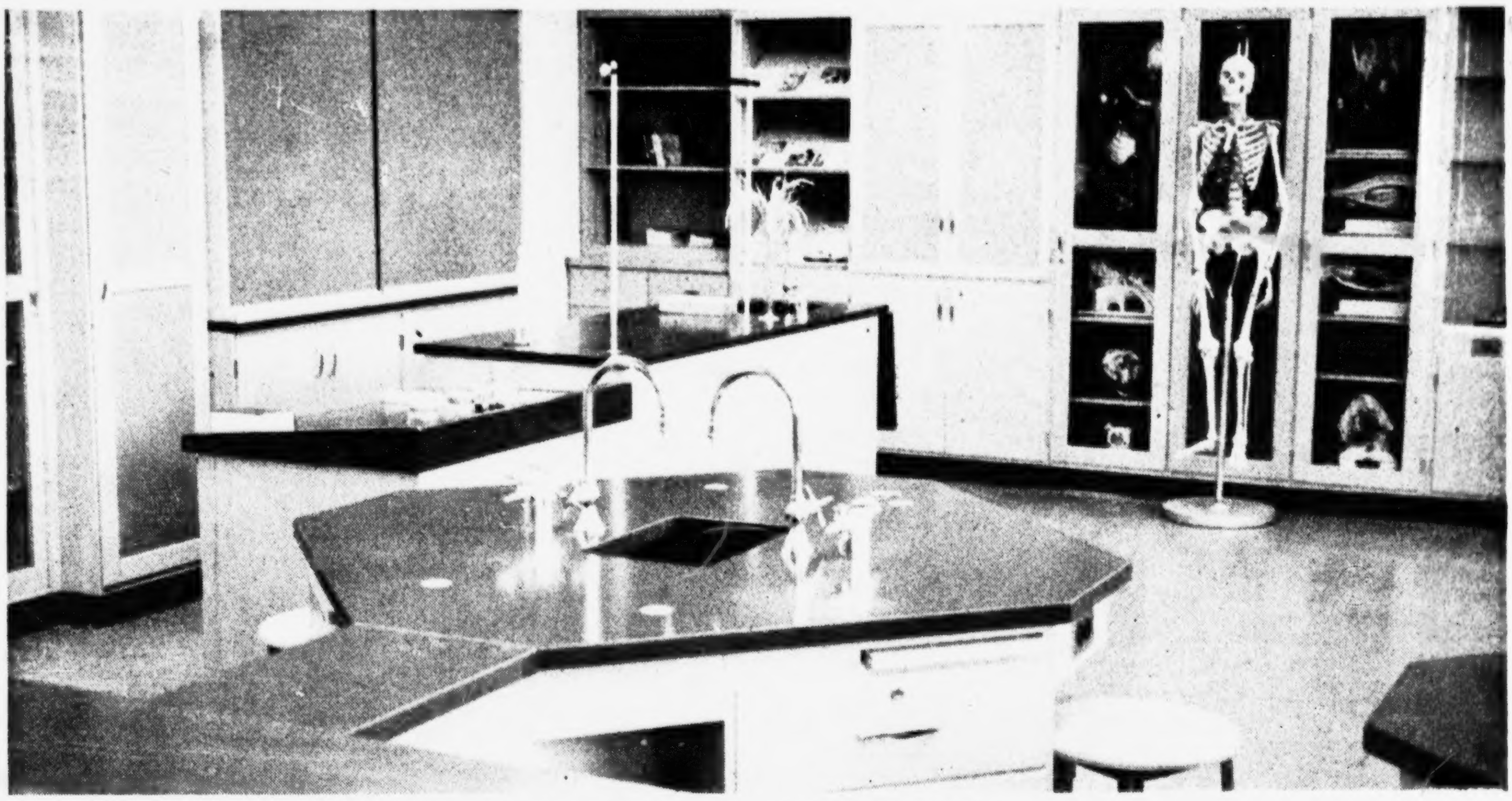
Note the panel chalk board behind which is storage area. Note display and storage cabinets where equipment is accessible to teacher.



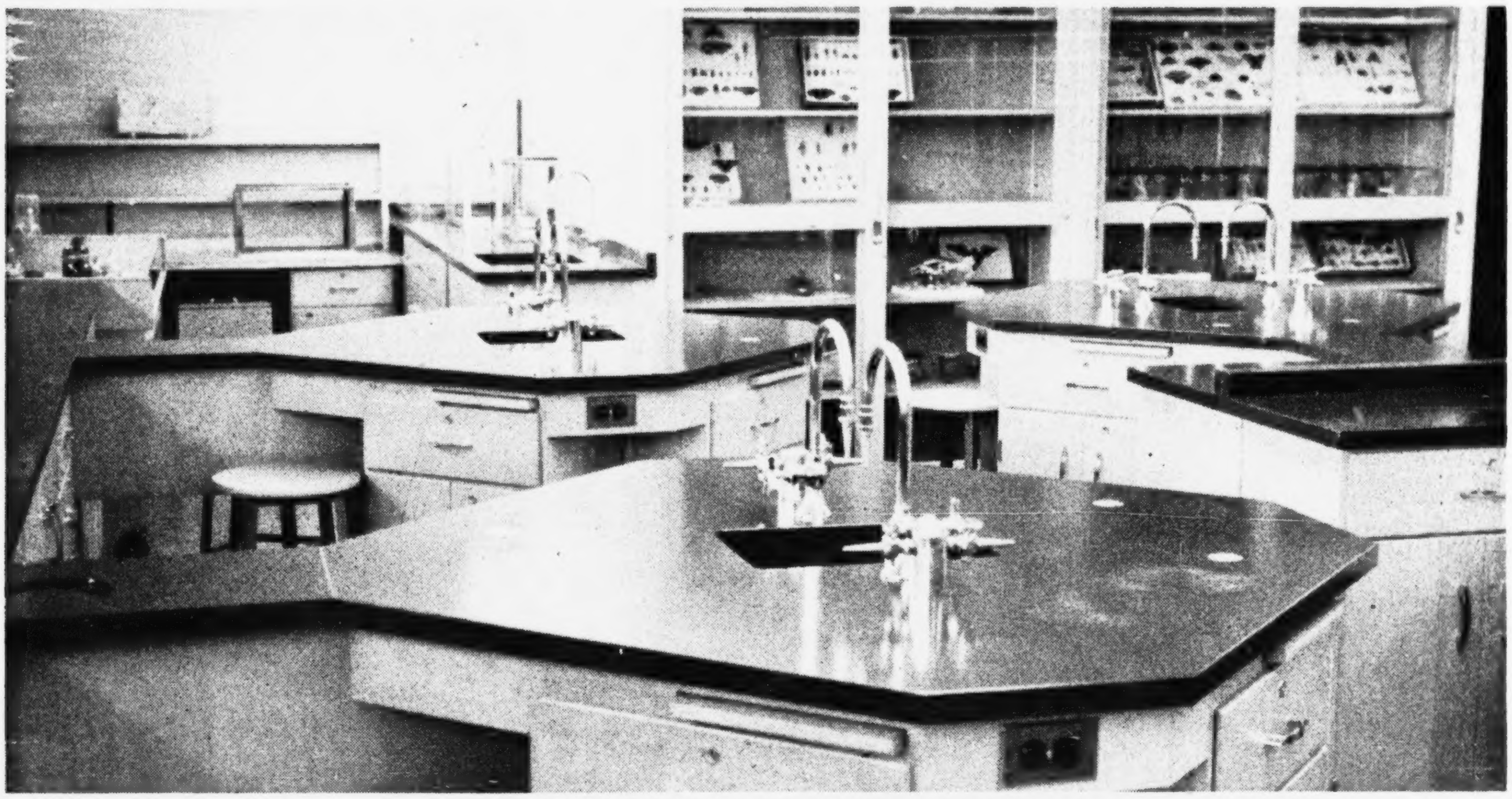
PHYSICS-CHEMISTRY ROOM—LABORATORY AREA

Note the preparation area behind fume hood with table sink unit, storage shelves, cabinets and peg board for glassware.

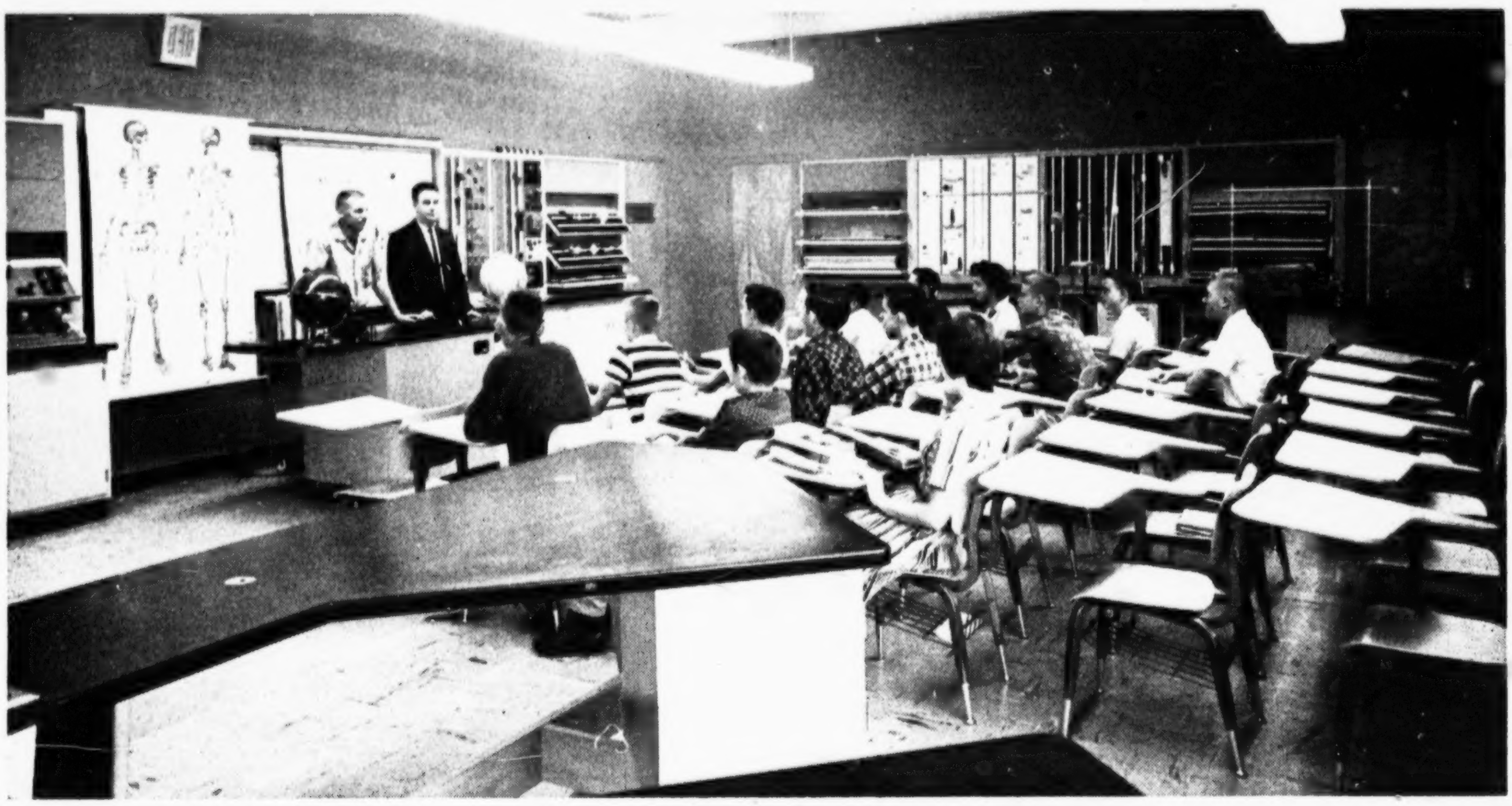
The tables are fully equipped including the lab volt units supplying variable AC and DC voltages.



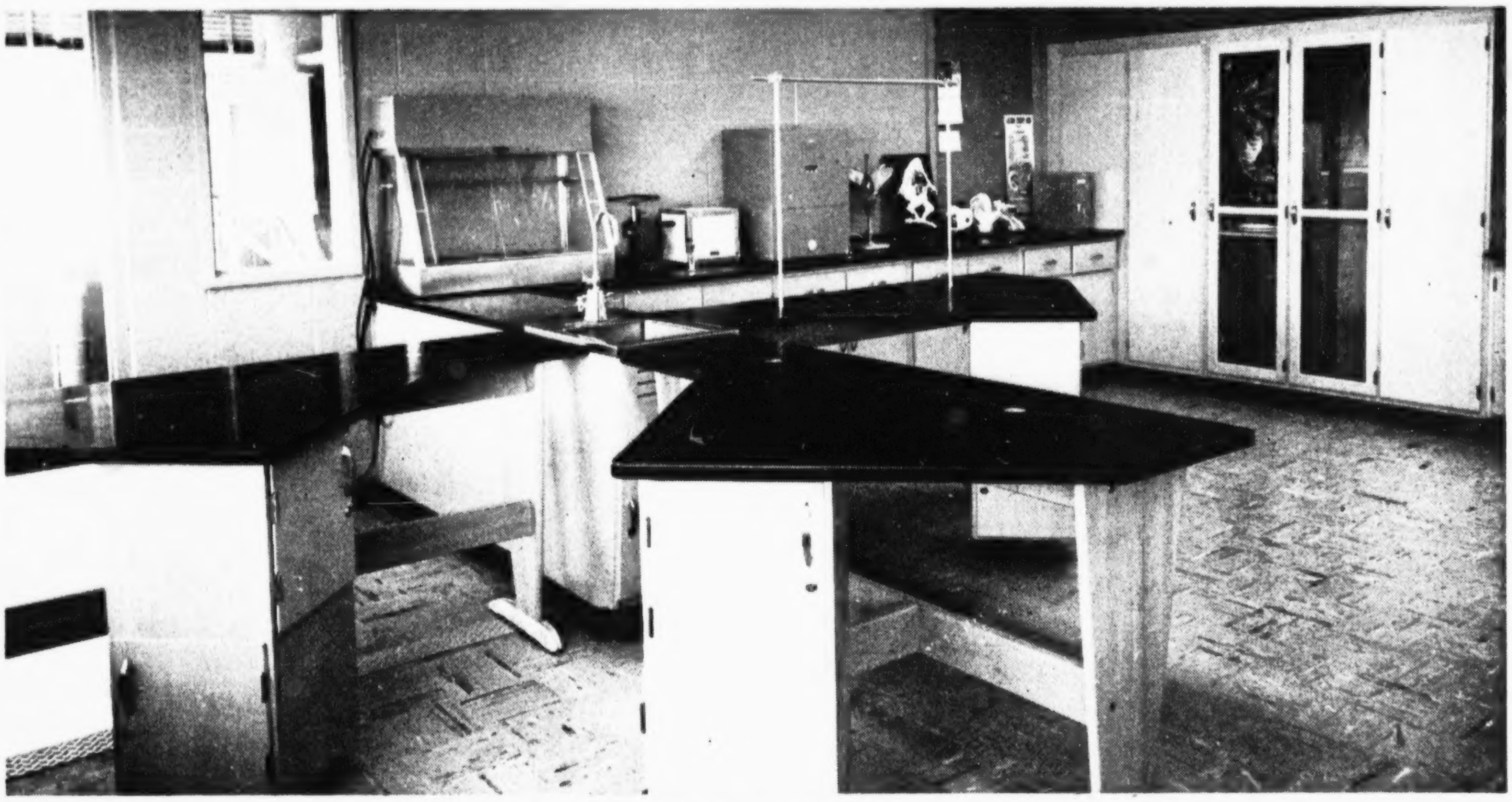
BIOLOGY ROOM—LECTURE AREA
Note skeleton models, display cases, demonstration desk, and laboratory table in the foreground.



BIOLOGY ROOM—LABORATORY AREA
In addition to well-equipped students tables, work tables are provided with sinks as seen at the left. The wall counter unit provides additional space for storage, aquarium, and general utility.



BIOLOGY—GENERAL SCIENCE ROOM
Observe the demonstration panels of equipment for general science.



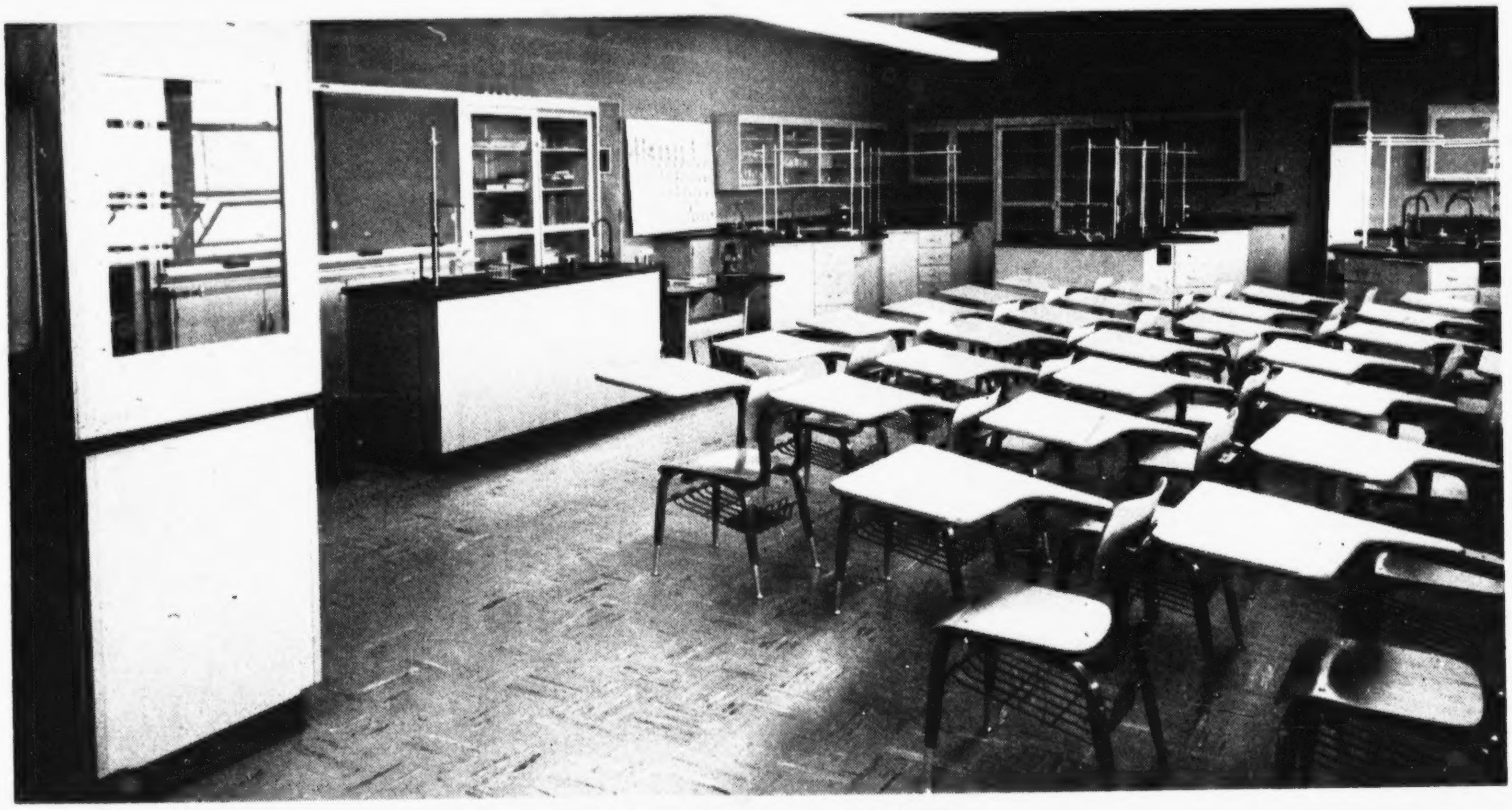
BIOLOGY—GENERAL SCIENCE ROOM
Observe the tables situated about the Service Island. Note the weather station equipment in the adjacent growing room. The weather station was later installed just outside the windows by this room.

LEFLORE COUNTY HIGH SCHOOL

Itta Bena, Mississippi

CHEMISTRY-PHYSICS ROOM

The students are working with semi-micro chemistry equipment obtained from a drawer in each desk.



CHEMISTRY-PHYSICS ROOM

Note the fully equipped fume hood in the foreground. Preparation area (not shown) is just back of fume hood. Very much experimental equipment was later added after the initial installation of the principal laboratory facilities.

GREENWOOD SENIOR HIGH SCHOOL

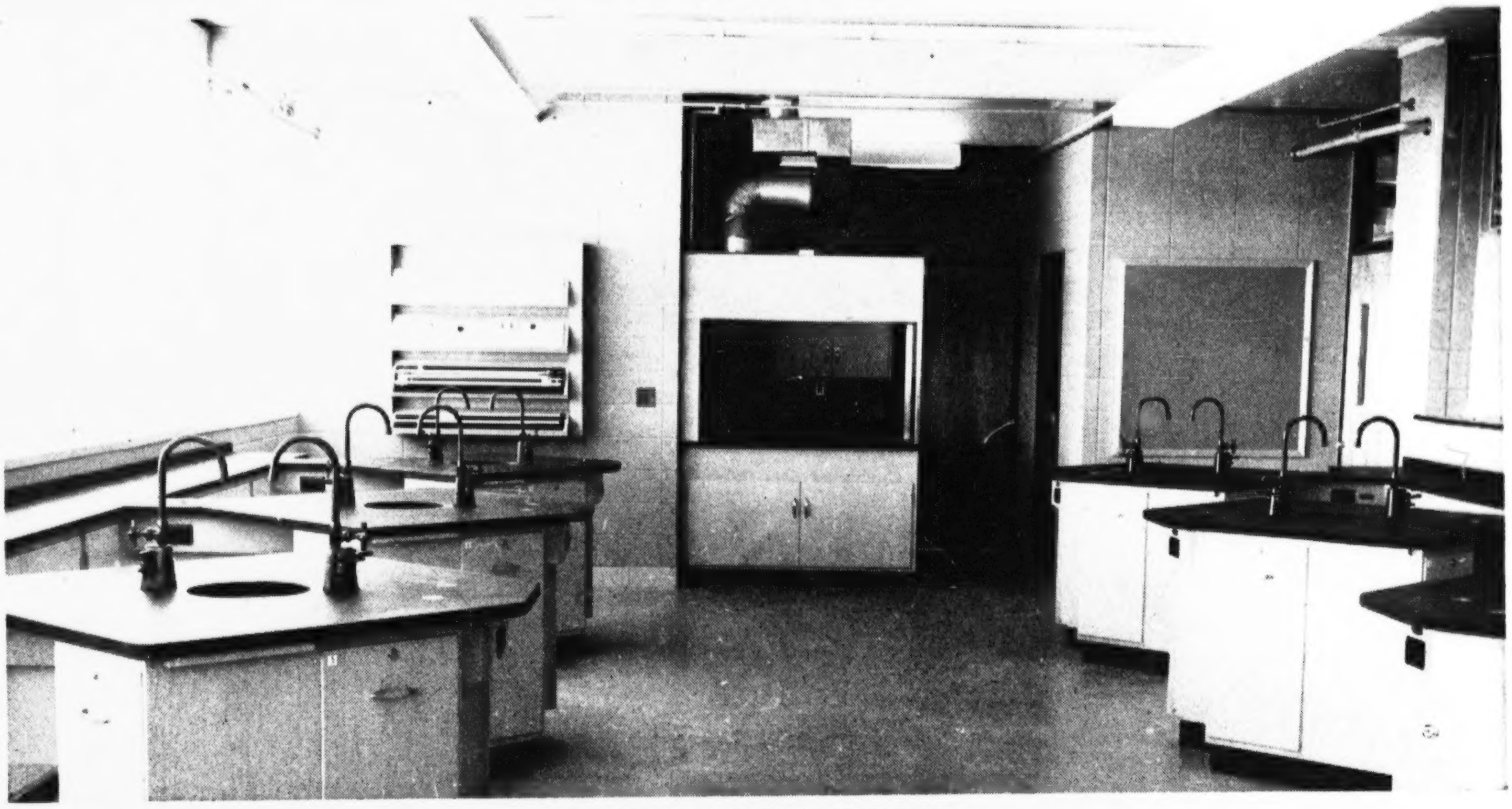
Greenwood, Mississippi

BIOLOGY ROOM

Above the wall counter table at the periphery of the room, a ledge provides for the display of student project winners of former science fairs. A science demonstration desk joined by teacher's desk provides for class demonstrations and necessary paper work. Students are studying some of the commercial models found in the room.

CARTHAGE HIGH SCHOOL

Carthage, Mississippi

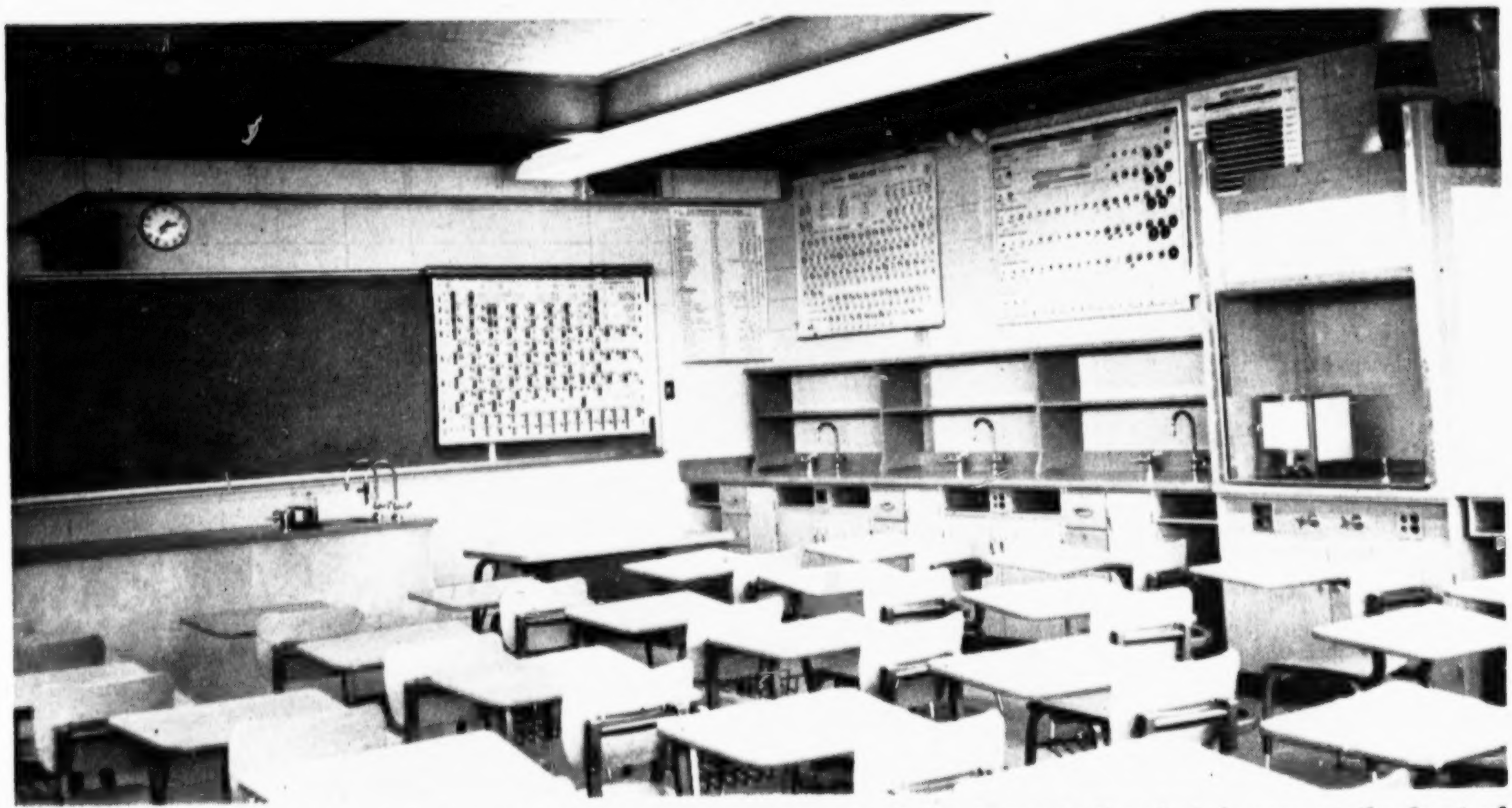


CHEMISTRY-PHYSICS ROOM

Tables and fume hood stand out in this picture. The fume hood installation permits working from either front or back sides.

NATCHEZ-ADAMS HIGH SCHOOL

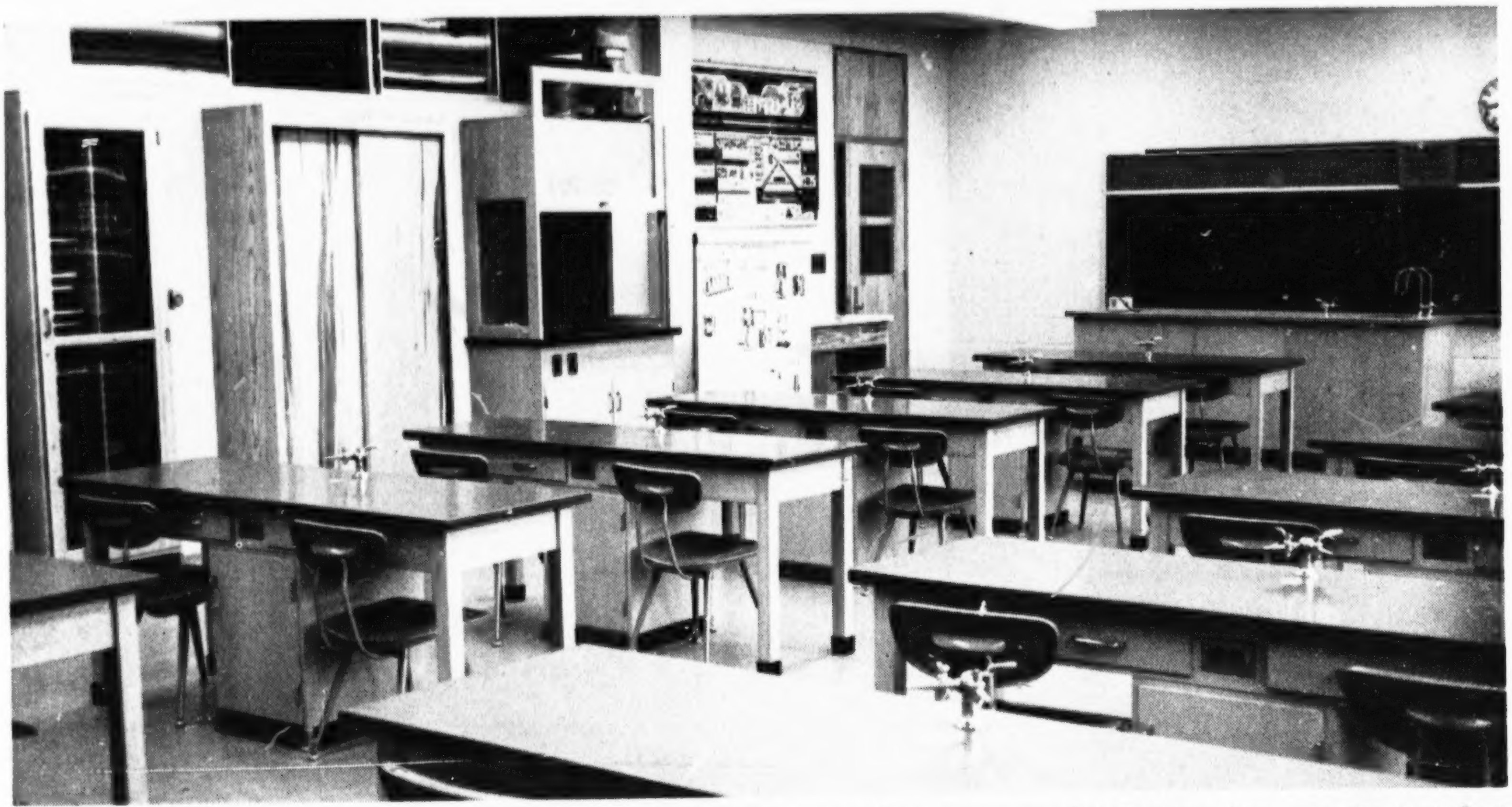
Natchez, Mississippi



Laboratory tables are at the periphery of the room. A large teacher's demonstration desk is seen at the front of the room.

BILOXI HIGH SCHOOL

Biloxi, Mississippi



Equipment seen here had just been installed when photo was taken. Some special features here are the 2-student physics table, large teacher's demonstration desk, and student notebook file.

CHAPTER 7

LAYOUTS (DRAWINGS) OF JUNIOR AND SENIOR HIGH SCHOOL LABORATORIES

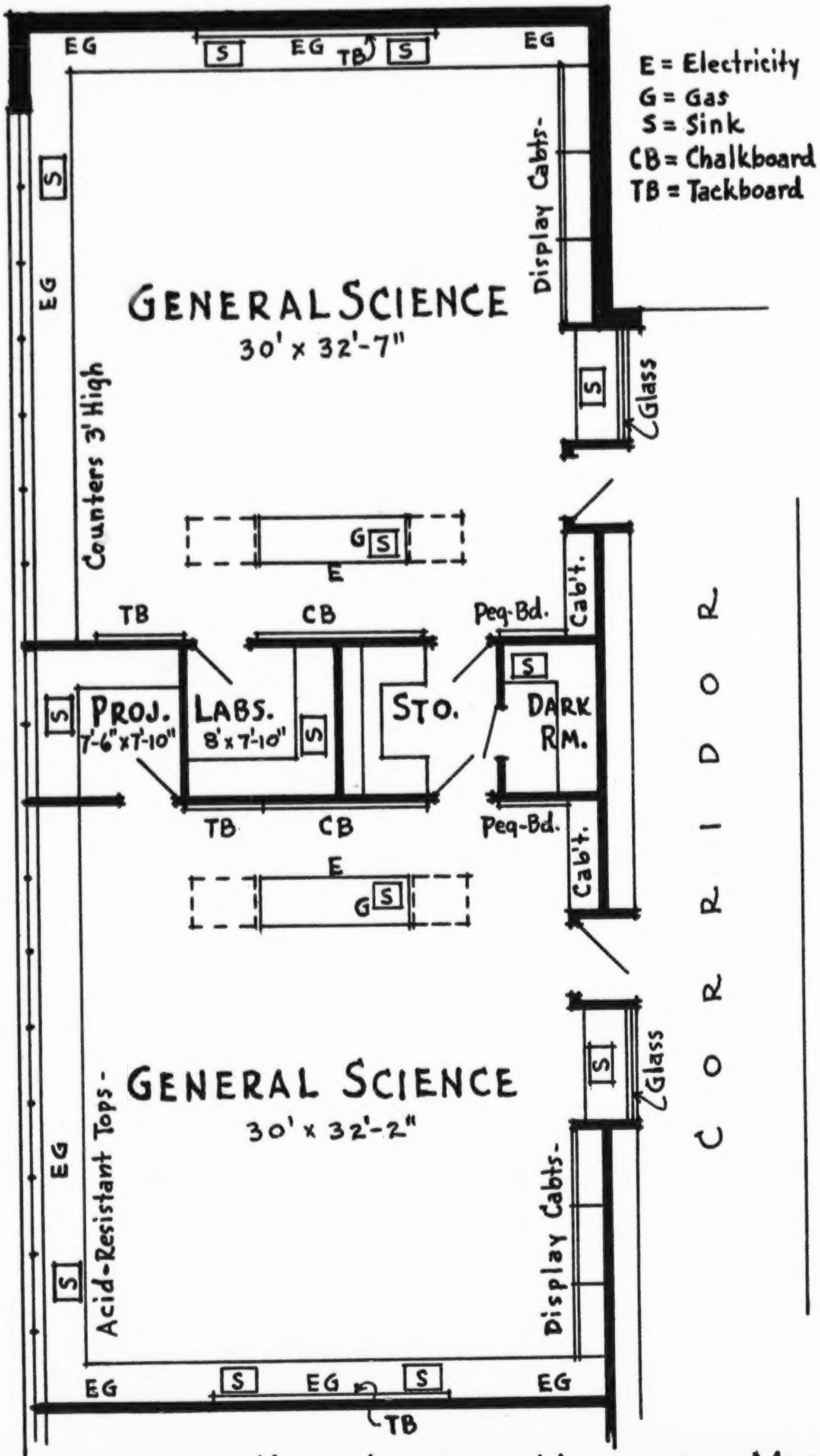
NORTHWEST JUNIOR HIGH

Meridian, Mississippi

This plan provides:

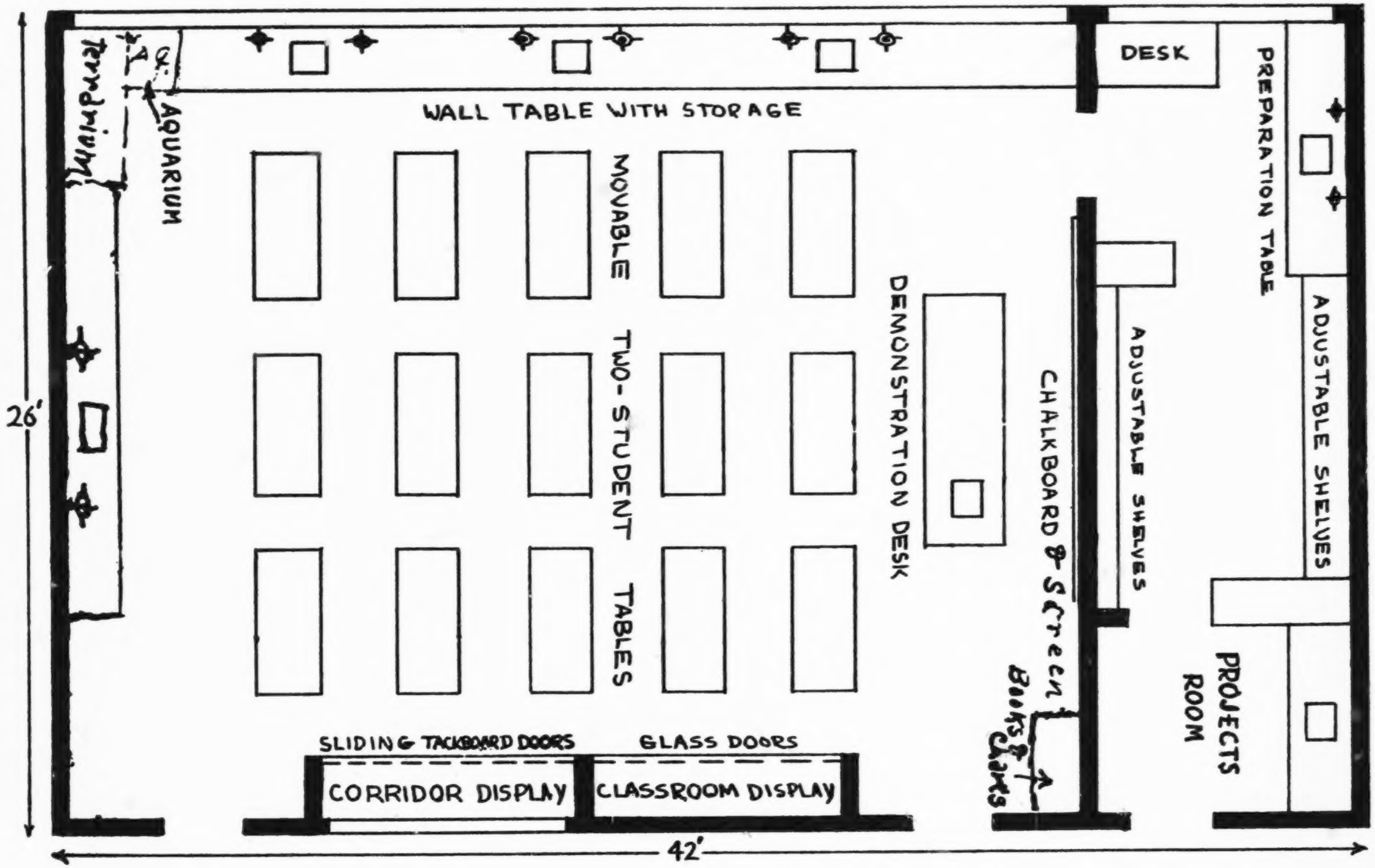
1. Wall counter tables with storage cabinets and sinks on one side and at the rear of the rooms. 2. Project rooms available to both rooms as well as a joint storage and darkroom. 3. A room which is almost square and which adapts itself to better utilization of space. 4. Wall display cases. 5. Provides for use of either tables or tablet arm chairs in center area. (In this case tables are used.)

Suggestion: More might have been provided in both classroom and storage area.


E = Electricity
G = Gas
S = Sink
CB = Chalkboard
TB = Tackboard
EG
S
TB
Display Cabts-
GENERAL SCIENCE
30' x 32'-7"
Counters 3' High
Glass
G
E
TB
CB
Peg-Bd.
Cab't.
PROJ.
7'-6" x 7'-10"
LABS.
8' x 7'-10"
STO.
DARK RM.
CORRIDOR
GENERAL SCIENCE
30' x 32'-2"
Acid-Resistant Tops-

NORTHWEST JUNIOR HIGH SCHOOL - MERIDIAN, MISS.

L-L-BRASFIELD - ARCH'T.


WALL TABLE WITH STORAGE
DESK
PREPARATION TABLE
ADJUSTABLE SHELVES
ADJUSTABLE SHELVES
PROJECTS ROOM
CHALKBOARD & Screen
Books & Charts
DEMONSTRATION DESK
MOVABLE TWO-STUDENT TABLES
SLIDING TACKBOARD DOORS
GLASS DOORS
CORRIDOR DISPLAY
CLASSROOM DISPLAY
AQUARIUM
Terrarium
26'
42'

CLASSROOM-LABORATORY FOR GENERAL SCIENCE IN GRADES SEVEN, EIGHT & NINE

JUNIOR HIGH LAB ROOM*

This junior high laboratory provides:

1. Economy — Through wall installation of water, gas, and electricity instead of providing the services to tables in center area. 2. Flexibility — Tables may be moved to the wall facilities for certain experiments. 3. Storage space — Storage space is available to students and teachers. 4. For Individual Work — In preparation room and project room.

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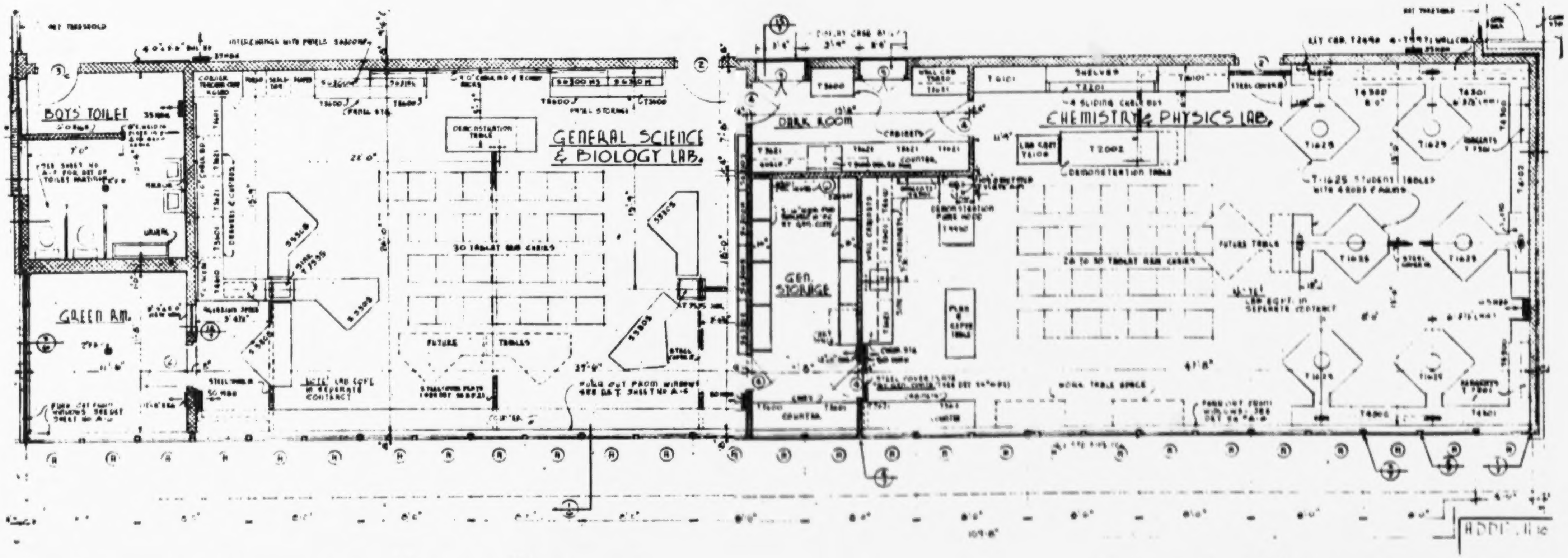
[*] Drawing reprinted from facilities For Teaching Science by Howard McCollum, Louisiana State Department of Education (August 1960).


BOYS' TOILET
GREEN RM.
GENERAL SCIENCE & BIOLOGY LAB.
DEMONSTRATION TABLE
30 TABLET ARM CHAIRS
FUTURE TABLES
DARK ROOM
GEN. STORAGE
CHEMISTRY & PHYSICS LAB.
DEMONSTRATION TABLE
26 TO 30 TABLET ARM CHAIRS
FUTURE TABLE
T-1625 STUDENT TABLES
47'-8"
26'-0"
109'-8"

LEFLORE COUNTY HIGH SCHOOL

JAMES A. McADAMS, ARCHT.

LEFLORE COUNTY HIGH SCHOOL

Itta Bena, Mississippi

The facilities at Leflore County High School reflect the keen insights and understandings of the functional aspects of a well-equipped science department. The facilities attest to the philosophy of the school administration and staff in their efforts to make adequate provisions for scientific training for a school of this size.

The science area consists of:

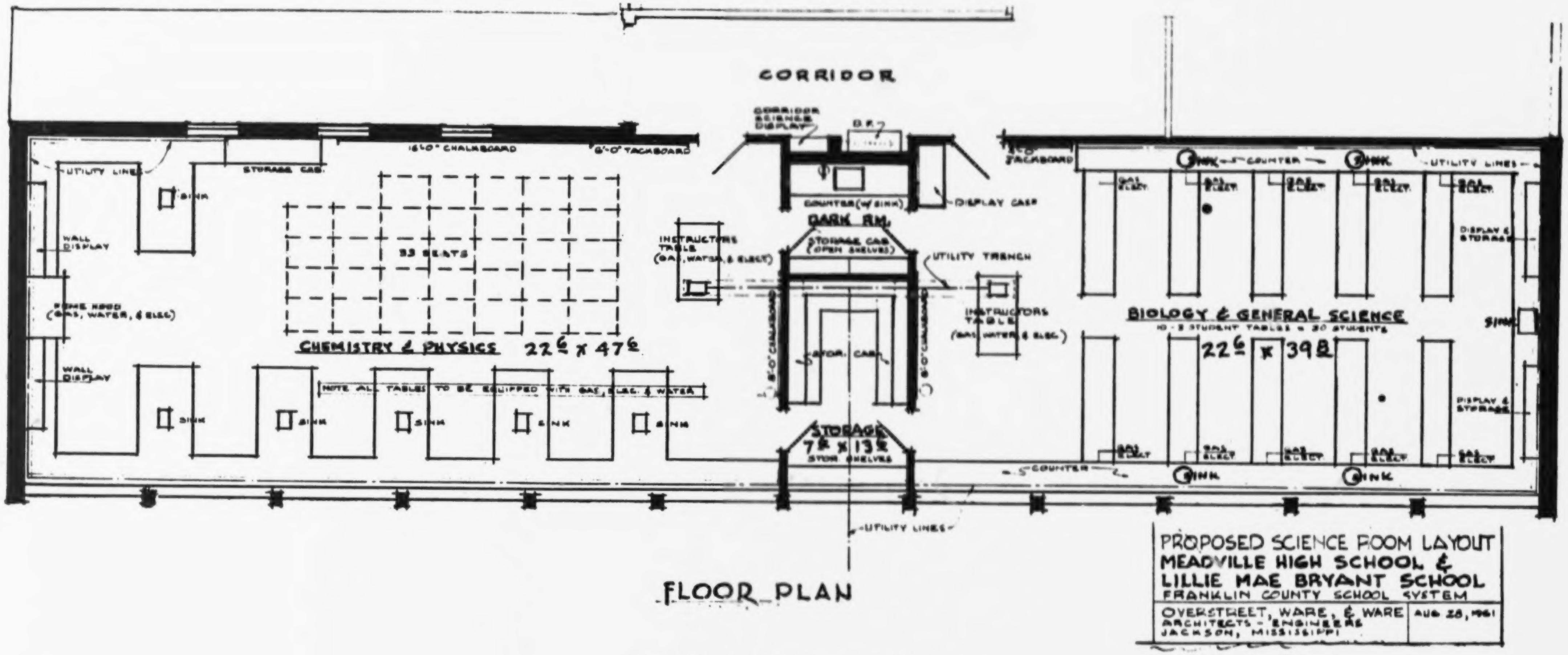
1. Chemistry-Physics Room—which is a combination lecture-lab with tables at one end and chairs at the other end. 2. Semi-micro chemistry equipment is provided and kept in the tables. 3. Preparation Room—back of the fume hood. 4. A darkroom with opening to corridor display cases. 5. General Storage Room 6. General Science—Biology Room—equipped with tables about service islands. 7. Assembled demonstrations panels of experimental equipment mounted at the wall. 8. A green room or growing room. 9. A weather station just outside the Biology-General Science Room.

Wall counter table space, reagent shelves, display cabinets, sliding panel chalk boards are available to students for science instruction.

The chemistry-physics room is 26 ft. by 47 ft., 8 inches.

The biology-general science room is 26 ft. by 39 ft., 6 inches.

The above dimensions do not include the area of green room, storage room, and darkroom.


CORRIDOR
CORRIDOR SCIENCE DISPLAY
D.F.
16'-0" CHALKBOARD
6'-0" TACKBOARD
STORAGE CAB.
UTILITY LINES
SINK
WALL DISPLAY
FUME HOOD (GAS, WATER, & ELEC)
33 SEATS
CHEMISTRY & PHYSICS 22⁶ x 47⁶
NOTE ALL TABLES TO BE EQUIPPED WITH GAS, ELEC. & WATER
INSTRUCTORS TABLE (GAS, WATER, & ELECT)
COUNTER (W/ SINK)
DISPLAY CASE
DARK RM.
STORAGE CAB (OPEN SHELVES)
UTILITY TRENCH
8'-0" CHALKBOARD
STOR. CAB.
STORAGE 7⁸ x 13⁸
STOR. SHELVES
UTILITY LINES
INSTRUCTORS TABLE (GAS, WATER, & ELEC.)
TACKBOARD
COUNTER
GAS ELECT.
DISPLAY & STORAGE
BIOLOGY & GENERAL SCIENCE
10-3 STUDENT TABLES = 30 STUDENTS
22⁶ x 39⁸
FLOOR PLAN
PROPOSED SCIENCE ROOM LAYOUT
MEADVILLE HIGH SCHOOL &
LILLIE MAE BRYANT SCHOOL
FRANKLIN COUNTY SCHOOL SYSTEM
OVERSTREET, WARE, & WARE
ARCHITECTS - ENGINEERS
JACKSON, MISSISSIPPI
AUG 28, 1961

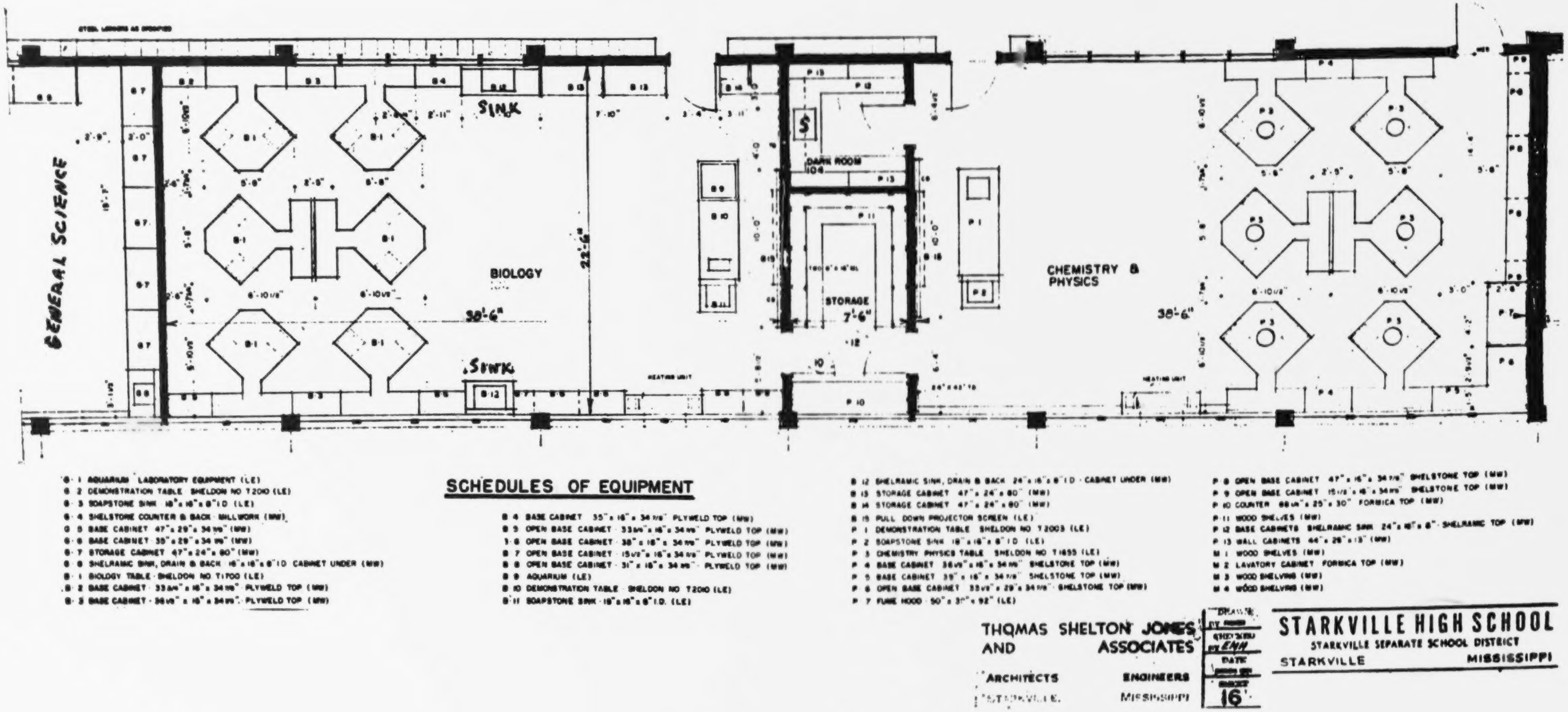
MEADVILLE HIGH SCHOOL
and
LILLIE MAE BRYANT SCHOOL
Meadville, Mississippi

This plan provides:

1. A wall arrangement of student tables in chemistry-physics room with a chair seating space on one side near the front. 2. A biology-general science room with tables to accommodate 3 students each for both lecture and laboratory purposes. 3. Considerable storage space around the walls and a central storage area. 4. Central storage and projects area accessible to teachers and students of both rooms.

Considerations:

As an alternative some may prefer the 2-student biology tables to the 3-student tables.


GENERAL SCIENCE
BIOLOGY
SINK
SINK
38'-6"
22'-6"
DARK ROOM 104
STORAGE
7'-6"
CHEMISTRY & PHYSICS
38'-6"
HEATING UNIT
STEEL LOUVERS AS SPECIFIED
SCHEDULES OF EQUIPMENT
B 1 AQUARIUM LABORATORY EQUIPMENT (LE)
B 2 DEMONSTRATION TABLE SHELDON NO T2010 (LE)
B 3 SOAPSTONE SINK 18" x 16" x 8" I D (LE)
B 4 SHELSTONE COUNTER & BACK MILLWORK (MW)
B 5 BASE CABINET 47" x 29" x 34 7/8" (MW)
B 6 BASE CABINET 35" x 29" x 34 7/8" (MW)
B 7 STORAGE CABINET 47" x 24" x 80" (MW)
B 8 SHELRAMIC SINK, DRAIN & BACK 16" x 16" x 8" I D CABINET UNDER (MW)
B 1 BIOLOGY TABLE SHELDON NO T1700 (LE)
B 2 BASE CABINET 33 3/4" x 16" x 34 7/8" PLYWELD TOP (MW)
B 3 BASE CABINET 36 1/2" x 16" x 34 7/8" PLYWELD TOP (MW)
B 4 BASE CABINET 35" x 16" x 34 7/8" PLYWELD TOP (MW)
B 5 OPEN BASE CABINET 33 3/4" x 16" x 34 7/8" PLYWELD TOP (MW)
B 6 OPEN BASE CABINET 30" x 16" x 34 7/8" PLYWELD TOP (MW)
B 7 OPEN BASE CABINET 15 1/2" x 16" x 34 7/8" PLYWELD TOP (MW)
B 8 OPEN BASE CABINET 31" x 16" x 34 7/8" PLYWELD TOP (MW)
B 9 AQUARIUM (LE)
B 10 DEMONSTRATION TABLE SHELDON NO T2010 (LE)
B 11 SOAPSTONE SINK 18" x 16" x 8" I.D. (LE)
B 12 SHELRAMIC SINK, DRAIN & BACK 24" x 16" x 8" I D CABINET UNDER (MW)
B 13 STORAGE CABINET 47" x 24" x 80" (MW)
B 14 STORAGE CABINET 47" x 24" x 80" (MW)
B 15 PULL DOWN PROJECTOR SCREEN (LE)
P 1 DEMONSTRATION TABLE SHELDON NO T2003 (LE)
P 2 SOAPSTONE SINK 18" x 16" x 8" I D (LE)
P 3 CHEMISTRY PHYSICS TABLE SHELDON NO T1655 (LE)
P 4 BASE CABINET 36 1/2" x 16" x 34 7/8" SHELSTONE TOP (MW)
P 5 BASE CABINET 39" x 16" x 34 7/8" SHELSTONE TOP (MW)
P 6 OPEN BASE CABINET 33 1/2" x 29" x 34 7/8" SHELSTONE TOP (MW)
P 7 FUME HOOD 50" x 31" x 92" (LE)
P 8 OPEN BASE CABINET 47" x 16" x 34 7/8" SHELSTONE TOP (MW)
P 9 OPEN BASE CABINET 15 1/2" x 16" x 34 7/8" SHELSTONE TOP (MW)
P 10 COUNTER 88 1/4" x 25" x 30" FORMICA TOP (MW)
P 11 WOOD SHELVES (MW)
P 12 BASE CABINETS SHELRAMIC SINK 24" x 16" x 8" SHELRAMIC TOP (MW)
P 13 WALL CABINETS 44" x 28" x 13" (MW)
M 1 WOOD SHELVES (MW)
M 2 LAVATORY CABINET FORMICA TOP (MW)
M 3 WOOD SHELVING (MW)
M 4 WOOD SHELVING (MW)
THOMAS SHELTON JONES AND ASSOCIATES
ARCHITECTS
ENGINEERS
STARKVILLE
MISSISSIPPI
DRAWN
CHECKED
EHH
DATE
SHEET
16
STARKVILLE HIGH SCHOOL
STARKVILLE SEPARATE SCHOOL DISTRICT
STARKVILLE
MISSISSIPPI

STARKVILLE HIGH SCHOOL

Starkville, Mississippi

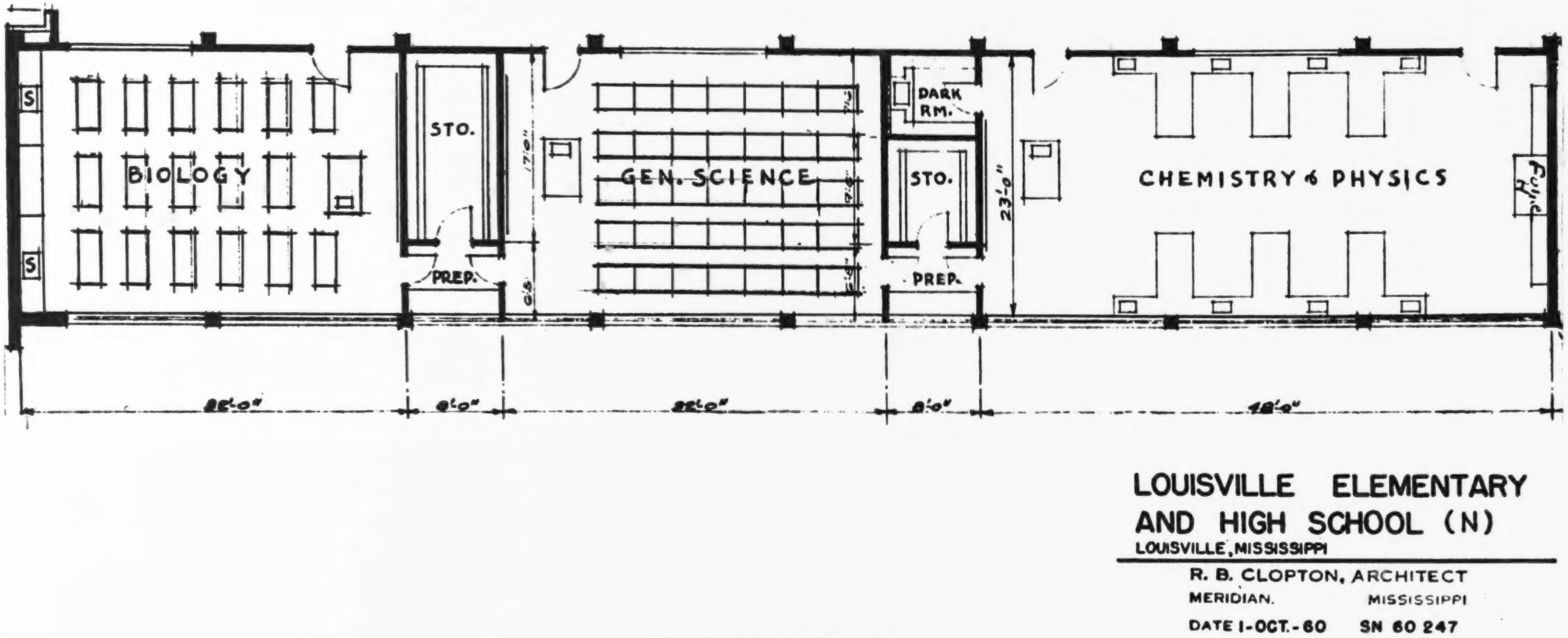
Chemistry-Physics and Biology

This plan provides:

1. Separate areas in the same room for lecture-discussion, and laboratory activities. 2. Central storage area with general equipment accessible to both rooms, and storage area in counter wall tables as well as in student tables. 3. Closer observation of student work by concentrating student tables in one area.

Considerations:

1. The biology room might have had a door at the rear of the room. 2. Additional sink units in the biology room at B^2 and B^3 locations would be useful.


S
S
BIOLOGY
STO.
PREP.
17'-0"
GEN. SCIENCE
DARK RM.
STO.
PREP.
23'-0"
CHEMISTRY & PHYSICS
Fume H
8'-0"
8'-0"
48'-0"
LOUISVILLE ELEMENTARY AND HIGH SCHOOL (N)
LOUISVILLE, MISSISSIPPI
R. B. CLOPTON, ARCHITECT
MERIDIAN. MISSISSIPPI
DATE 1-OCT.-60 SN 60 247

LOUISVILLE HIGH (N)
AND
ELEMENTARY SCHOOL

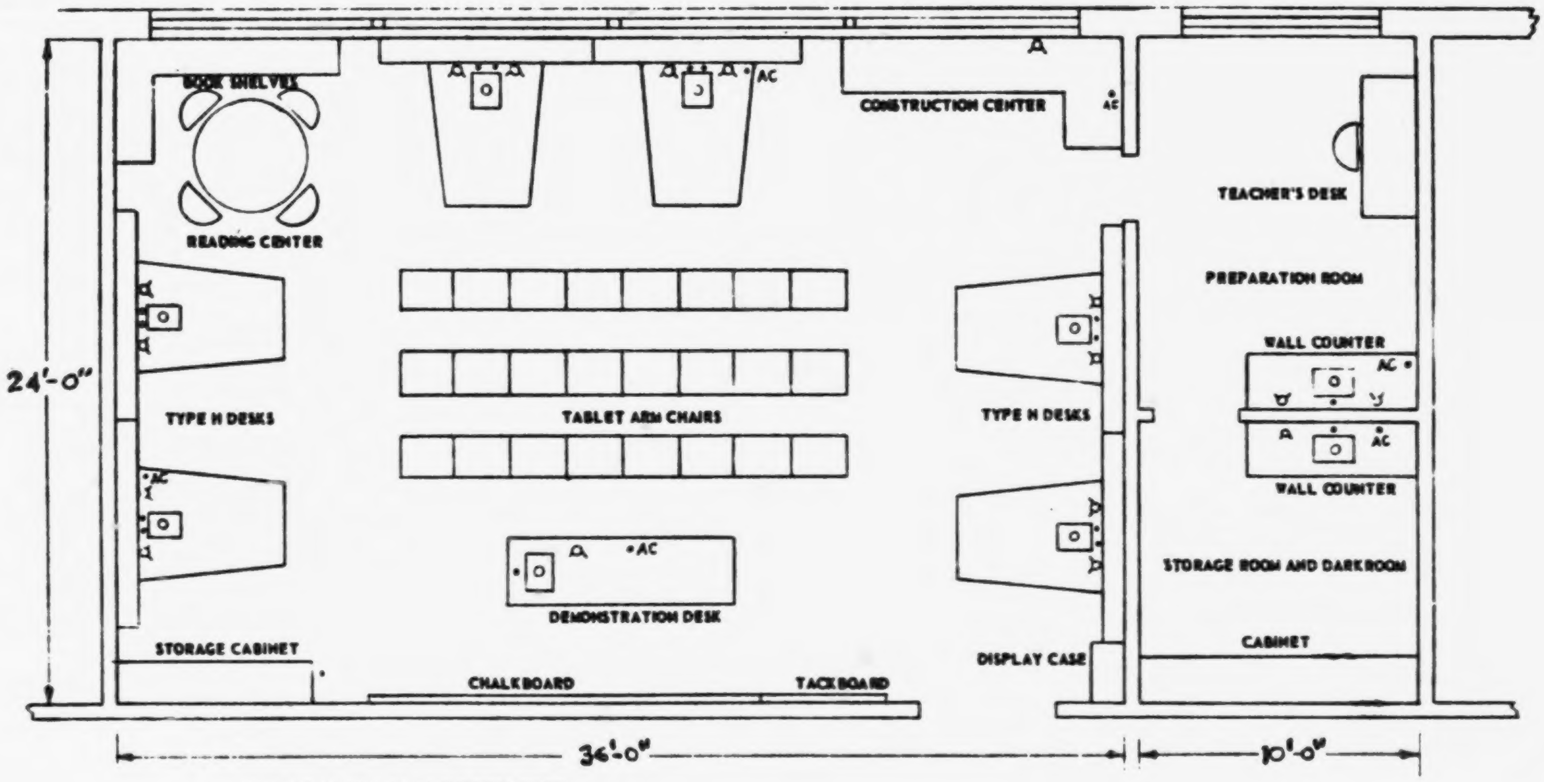
Louisville, Mississippi

This plan provides:

1. A chemistry-physics room with sinks in wall counter area rather than the tables. 2. Storage rooms, preparation rooms and a darkroom accessible for teacher use at the nearby demonstration tables. 3. Movable biology tables with some wall sinks, a desk chair area in general science room.

Considerations:

1 Tables in physics-chemistry room might have been moved farther toward the rear allowing more chair area in the front of the room. 2. The General Science room might be equipped with wall counter tables or tables of other type through the room, providing student work area. 3. More space in biology and general science rooms would be desirable.


BOOK SHELVES
READING CENTER
AC
CONSTRUCTION CENTER
AC
TEACHER'S DESK
PREPARATION ROOM
WALL COUNTER
AC
AC
WALL COUNTER
24'-0"
TYPE H DESKS
TABLET ARM CHAIRS
TYPE H DESKS
AC
AC
DEMONSTRATION DESK
STORAGE ROOM AND DARKROOM
STORAGE CABINET
CHALKBOARD
TACKBOARD
DISPLAY CASE
CABINET
36'-0"
10'-0"

PHYSICAL SCIENCE ROOM*

Physics and Chemistry Room

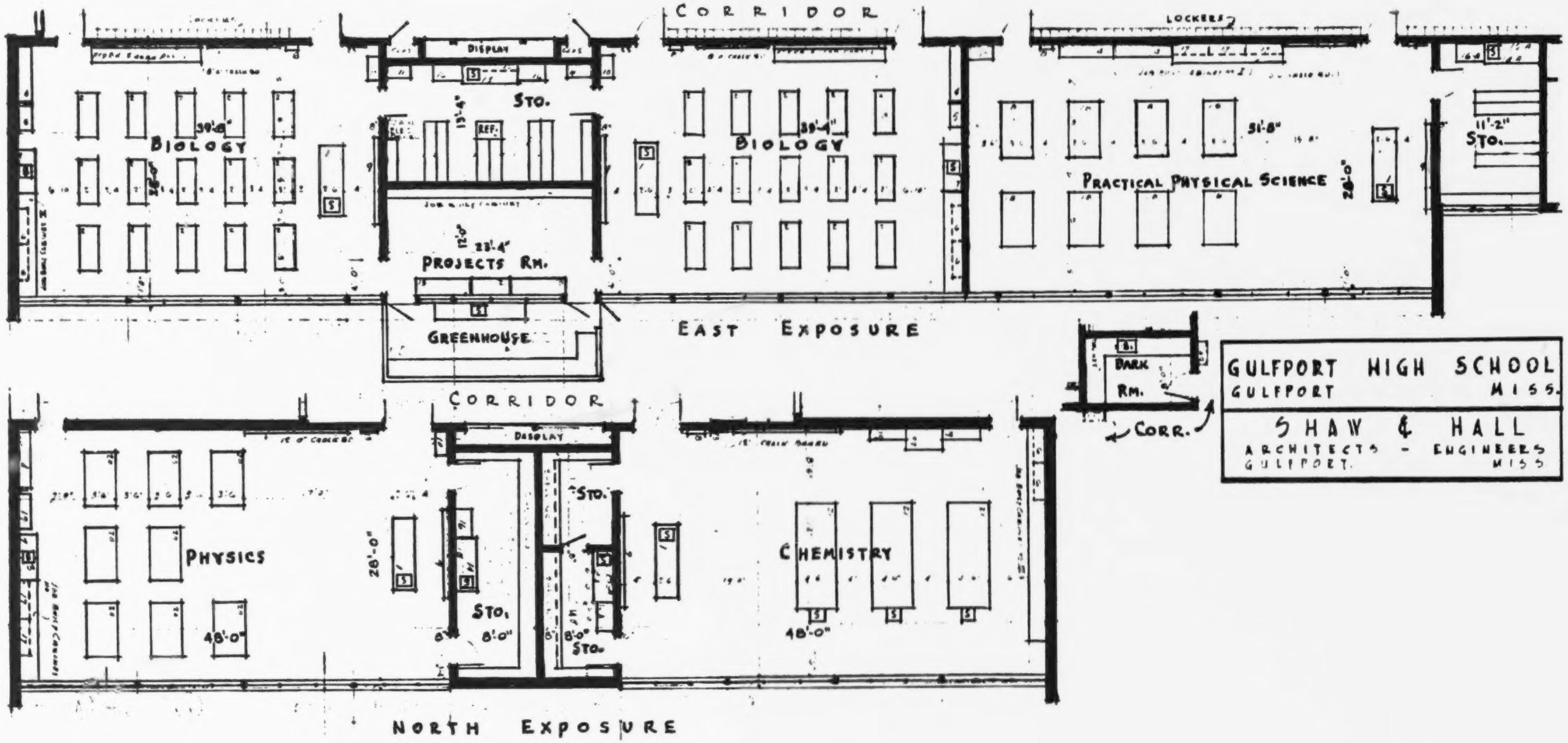
This plan provides:

1. Sufficient space—for chairs in center area with tables around the walls. 2. For varied group and individual activities. For example: experiments, project work, construction and repair, reading, and use of audio-visual aids. 3. Tables fully equipped with utilities and storage space.

Considerations:

A door might be added to connect preparation-storage room to adjacent room allowing for expansion with increase in enrollment.

*Drawing reprinted from School Facilities for Science Instruction, National Science Teachers Association (1954.)


CORRIDOR
LOCKERS
DISPLAY
STO.
BIOLOGY
30'-4"
REF.
13'-4"
23'-4"
PROJECTS RM.
BIOLOGY
30'-4"
PRACTICAL PHYSICAL SCIENCE
51'-8"
28'-0"
11'-2"
STO.
GREENHOUSE
EAST EXPOSURE
DARK RM.
CORR.
GULFPORT HIGH SCHOOL
GULFPORT MISS.
SHAW & HALL
ARCHITECTS - ENGINEERS
GULFPORT MISS
CORRIDOR
DISPLAY
PHYSICS
48'-0"
28'-0"
STO.
8'-0"
STO.
8'-0"
CHEMISTRY
48'-0"
NORTH EXPOSURE

GULFPORT HIGH SCHOOL

Gulfport, Mississippi

This plan provides:

1. For more specialization in facilities--biology, physics, chemistry, and physical science. 2. For the needs of larger schools. 3. Two communicating biology rooms with large project room and storage room between them. The biology tables are used for both lecture and lab. 4. An associated growing area labeled as greenhouse. 5. Separate physics and chemistry rooms, each with storage and display space. 6. Aseparate physical science room.

The science department at Gulfport High School is in a separate science building.

The sketches show the correct positions of biology and practical physical science with respect to one another, also the position of physics lab in relation to chemistry; however, the physics-chemistry wing is not properly orientated in the sketch. The physics-chemistry wing actually occupies a position at right angles to the other wing with physics and physical science in juxtaposition.

PART II

ELEMENTARY SCHOOL SCIENCE FACILITIES

CHAPTER 1

GENERAL AND SPECIAL FACILITIES REQUIRED

Science experiences in the elementary school are a part of the total education of the pupil. It is difficult, if not impossible, to isolate these experiences from the total school program. However, a definite program in science must be followed if the formative skills, attitudes, interests and knowledge in science are to be developed at this important early age.

Even though science is usually taught in a self-contained classroom in the elementary school by a classroom teacher who is often not a specialist in science, certain facilities, equipment and materials are essential if a good program, or even an acceptable program, is conducted in science. It is the purpose of this bulletin to cover the subject of facilities rather than materials, yet certain basic materials are included for discussion at this level.

SPECIAL FACILITIES NEEDED FOR SCIENCE INSTRUCTION

The elementary age child acquires science facts and concepts through many types of media of communication. In view of this principle, the elementary school classroom should be equipped with special facilities to permit learning through a variety of learning techniques. This requires many facilities to be used either by the student or teacher, or both. The presence of such facilities for science in the classroom will not deter but rather will aid the instruction in other areas. This is particularly true when the teacher sees science as an integrated part of the total learning experiences.

For the use of a variety of techniques, the classroom should contain the following:

1. Demonstration table, mobile — for teacher use. The usual type is a portable table, on casters, chemically resistant top, a small stainless sink with a pump faucet, fresh water and waste tanks (polyethelene), shelves possibly with trays, removable Greenlaw arm, and an electrical receptacle with connecting cord. The table is high enough that pupils may easily see the demonstrations.

2. Work table for children—One or more tables may be provided where students may sit or stand, handle materials, and receive instruction. A movable table (with or without casters), either rectangular or circular, where students may work all around the table is better in some ways than the fixed table. For a group of 30 a minimum of 18 sq. ft. of working table space should be available. Additional table space is required for the use of tools.

3. Wall counter—The fixed wall counter table with shelves, doors and drawers, and a water-sink unit is becoming standard equipment in elementary classroom construction. This provides student work area, display space, and storage space. The wall counter unit should be covered with a heat resistant and chemically resistant material such as formica.

4. Germinating bed—The germinating bed may be on casters, with drain, and contain auxiliary shelf space for pails of soil, sand, peat, etc. Window frames or boxes may also provide germinating and growing area.

5. Aquarium— A 5 to 10 gallon aquarium in every room stimulates interest in aquatic life and increases interest in many biological principles.

6. Water and sink unit—If sink is not provided in wall counter unit, then a separate sink unit should be in the classroom.

7. Cages and cases—Cages for keeping animals and cases for display of science materials are needed in the elementary classroom. Cases are useful for collections such as insects, rocks, shells, seeds, and products from industrial processes such as petroleum products.

8. Globe—A terrestrial globe and possibly an astronomical globe are needed for science related instruction. Plain slated globes, too, are desirable.

9. Microscope—At least one good microscope in every room is very desirable.

10. Microprojector, Motion Film Projector, Filmstrip Projector, Opaque Projector—These

should be available from some central storage room accessible to all teachers. If funds should permit every room to have a projector, then it may be more ideally equipped.

11. Science kit—The science kit idea is an attempt to equip the classroom with a minimum amount of demonstration and experimental equipment for the doing of a number of experiments. Such a kit contains a variety of possibly unrelated items. A more specialized type of kit consists of related items adapted only to a specific purpose such as a radio kit. A kit is usually insufficient in that it lacks many necessary items for doing all experiments that a class desires to do. The classroom should be equipped with at least **basic equipment** and **materials** recommended by the State Department of Education on the **Title III, NDEA, Elementary Science List.** When the classroom is provided with the basic items contained in the list, a very definite attainment has been made in realizing a more adequate elementary science program.

12. Electrical outlets—This important facility should not be overlooked. Outlets should be available both at the front and rear of room, at the wall counter unit and possibly elsewhere. The use of audio equipment and projection equipment demands electrical outlets. Hot plates and other equipment require the 110 volt outlet.

GENERAL FACILITIES FOR ELEMENTARY SCIENCE

The following items are needed for science use and other instructional purposes.

Storage Cabinets

Teachers always need storage space for materials, equipment, and supplies. Some storage space may be built in accord to the plan of room construction, but building plans should provide for location of cabinets as needed. Cabinets with adjustable shelves are more adaptable. A minimum of 12 ft. of 18 inch shelf space is desirable for science. More is needed for other purposes.

Projection Screen

A standard roll type projection screen may be mounted 18 to 24 inches above the chalk board on special brackets. Screen size 50" by 50" up to 70" by 70" will serve needs of the classroom.

Book Cases

Open bookshelves or bookcases are required for supplementary texts, reference books and special interest readers.

Filing Cabinet

A filing cabinet for pupil records, reports, science clippings and pictures, and other classified material should be available and accessible to the teacher.

Display Boards (Bulletin Board)

Science bulletin boards are valuable aids to learning. Frequent changes with up-to-date material will capture students attention. All class members, or possibly a rotating committee, should be utilized in keeping up the bulletin board.

Chalk Board

The chalk board is a most important facility. Sliding panel chalk boards and reversible chalk boards on stands have gained widespread acceptance. Metal chalk boards with magnetic pieces are useful. They are used for display or for developing a story in a way similar to a flannel board.

Room Darkening Facilities

The room must be darkened for projection purposes and certain experiments requiring darkness. Opaque roller shades, venetian blinds or drapes may be effective darkening facilities. Regulations of Title III, NDEA in Mississippi permit the darkening of one half of the classrooms of an elementary school on a reimbursable basis, if proper darkening facilities are acquired. This means that if all rooms are darkened in an elementary classroom building, NDEA funds would pay ¼ of the cost.

Science Center

A classroom may have a certain designated area known as the Science Center. It is an area of the room where special attention is drawn to science. It may contain exhibits, charts, globe, pictures, tables, work counter, or other special facilities for science. The experimental equipment might also be kept in this area. Whether equipment is kept here or in other room area, the room should be equipped with many items of equipment such as balances, batteries, magnets, compasses, thermometers, beakers, glasses, microscope, globe, lens, mirrors, motors, aquarium, measuring devices and many other items.

Laboratory Center

Certain types of equipment and materials may be shared by a number of classrooms in the elementary school. The central storage room or laboratory center provides for keeping of such equipment. The laboratory center should be accessible to all teachers (but not in the principal's office) where teachers feel free to take equipment from the center to the room according to established policies. Shared equipment ordinarily found at the center may be electrical meters, microprojector, microscopes, motion projector, opaque projector, film and filmstrips, models, planetarium, telescope, vacuum-pressure pumps, other equipment, and stock quantities of materials and supplies.

In some cases, science kits and mobile demonstration desks may be shared by 3 or 4 teachers; but experience has shown that the use of this type of equipment is far more extensive and satisfactory if readily available in the room. Display space for sharing, on a school-wide basis, the tangible results of children's work in elementary science also is desirable. If a small room is available, it may be provided with such display space as well as with cupboards for the storage of equipment. Display cabinets may be located in the halls of the school if sufficient space is available.

In those schools where teaching of science is the responsibility of a specialist, a laboratory may be provided. This laboratory should be equipped so that a minimum of 4 square feet of mar-resistant working space is available for each child. The number of electrical and gas outlets, storage cupboards, open shelves for equipment and books, window shelves, aquarium tables, and display cabinets and/or shelves needed in the laboratory will be estimated best by the science specialist, who should be consulted before remodeling is undertaken. Each laboratory should have dark shades and at least one sink. In some instances, a demonstration table equipped with a sink, an electrical outlet, a gas outlet, and a support stand for suspending certain items of apparatus will also be useful.

Remodeling—The **Purchase Guide** prepared by the Council of Chief State School Officers contains a special section on remodeling for science at the elementary school level.

CHAPTER 2

AUDIO-VISUAL AIDS AND MATERIALS FOR ELEMENTARY SCIENCE

Visual aids are very effective means of communication at the elementary level. The lack of adequate vocabulary necessitates the use of visual communication, yet the principle still holds that the visual impression when supplemented by the audio component is far more effective.

Audio-visual aids mean much more than "showing a film." There are many devices other than film and film projectors which may be valuable in acquainting students with the exact nature of some object or substance, or with some concept. The more frequently used audio-visual aids are chalk boards, charts, diagrams, pictures for the bulletin board or pictures shown by opaque projector, models and specimens, as well as motion picture films, filmstrips, and colored or black and white slides.

When live or preserved specimens are used, children have opportunity to have direct experiences. The actual object, industrial plant, animal, etc., should be observed wherever the conditions will permit. Models, pictures and other symbols are only convenient substitutes for the actual object in the classroom.

Full use should be made of the nearby nature areas, museum, zoo, or other scientific places.

Pictures

Many teachers keep a file of pictures which have either been purchased as a set or clipped from various magazines. The room should have extensive bulletin board area for display of pictures. Pictures in books and magazines may be identified by subject, book, and page reference for use in opaque projector, and a record kept of this data.

Charts

A great number of charts of elementary science have been produced by the major chart and map companies. In addition to these a great number of industrial companies and other agencies offer special science charts free to schools. Among these would be U.S. Steel, General Motors, Westinghouse, General Electric, National Foundation, and many others.

Films (available for purchase)

138 Coronet films correlated with texts, intermediate level (4, 5, 6)

E. B. F. Films — Science for the Space Age (grades 5 to 9) 15 films of the Basic Physical Science series

International Film Bureau—Natural Life Series and others

McGraw Hill — Correlated text films, life science and physical science Primary and middle grades

United World Films—The Living Science Series (Physical Science) —all grade levels

Film Associates of California—Several on life science and physical science, elementary and junior high

Colonial Films

Free loan films in Mississippi

Schools not members of one of the cooperative film libraries still may find free loan films available. Some sources of free loan films for elementary science are listed below:

1. Miss. State Board of Health
2. Mississippi State Game and Fish Commission
3. Mississippi Agriculture Extension Service, Mississippi State University
4. Educators Guide to Free Film, Educators Progress Service, Randolph, Wisconsin
5. H. W. Wilson Film Guide, 950 University Avenue, New York, N. Y.
6. U. S. Government Films, Bulletin No. 1, Supt. of Documents, Government Printing Office, Washington, D. C.
7. Various sponsored film libraries

Filmstrips

Most schools are able to stock and keep on hand a certain number of selected filmstrips for the teaching of science. These should be carefully selected (previewed before purchased) and acquired for use for a very definite instructional purpose. They may be good aids to instruction, but care should be exercised in obtaining only those which fit in with the topic and aims of instruction.

Some producers of filmstrips are:

Encyclopedia Britannica Films
Society for Visual Education
Curriculum Films
Eyegate
Jam Handy, Inc.
Children's Press
McGraw Hill
Popular Science

Projectors

A 16mm motion picture projector and a filmstrip projector should be available for every classroom. The opaque projector can be a valuable teaching device in the hands of a versatile teacher. The room should be equipped with room darkening facilities to obtain best results. The overhead projector has the special advantage of projecting a figure, drawing, etc., as the teachers develop the story under normal lighting conditions.

Science Records

Some good records are available. Among those are several records available from Cornell University with titles such as "Songbirds of America," "Voices of the Night" — (toads and frogs), and "The Songs of Insects."

Available from Stanley Bomar Co., Valhalla, New York, and Flicker Records, Old Greenwich, Connecticut, are records of many different bird songs. "Science of Sound" and "Science in Our Lives" and a number of other science records may be obtained either from Mississippi School Supply Co., Jasper Ewing, or Herschel Smith, Jackson. These companies also handle some of the films and filmstrips listed above.

CHAPTER 3

BASIC EQUIPMENT AND MATERIALS FOR ELEMENTARY SCHOOL SCIENCE

An effort to provide some scientific experiences in the total school program of the elementary school should be made at once with the equipment on hand and that which can be obtained locally.

Then the following items, regarded as **basic**, should be supplied to each elementary classroom as quickly as possible.

ITEMS	DESCRIPTION
Animal cages-observation of small animals	Collapsible, glass, rigid
Aquarium	Minimum size 6 gal.
Aquarium equipment	
Dip net	
Sand and gravel	
Air line valve	Brass, 3 way
Asbestos board	Sheets for heat insulation
Balance, Harvard Trip	Flat pan balances
Ball and ring set	For expansion when heated
Batteries, dry cell	
Beakers, pyrex	Assorted sizes from 100 to 1000 ml.
Bell, electric	Low voltage
Books	See **Science Book List for Children** by Hillary Deason, **The Traveling Elementary School Science Library**, and other references
Bottles, wide mouth	8 ozs. or approximately
Burners	Alcohol, bunsen or propane gas burner
Charts, elementary science	Atom, bird, first aid, general science, health, hygiene, or mammal
Clamps, burette	
Collection sets	Minerals, rocks, and seeds
Compass, magnetic	Minimum diameter 45 mm
Corks	Assorted size range #0 to 26 mm
Crucible, porcelain	Size #0 or approximate size
Desk, portable demonstration	On casters, equipped for water, drainage, electricity, with vertical and horizontal rods — cabinet space
Dishes for science experiments	
Forceps	
Friction rods	Glass, vulcanite (hard rubber)
Fur, piece for rubbing	
Funnel	65 mm diameter or other sizes
Glass slides, clear microscopic	
Cylinders	50 ml to 1000 ml
Hot plate	Electric (one or two eyes)
Iron filings	
Iron spoon	For heat and chemical work
Lamp chimney	
Lamps, miniature	Screw base preferred
Lamp sockets, miniature	
Lenses	Demonstration set
Magnets	Bar, horseshoe
Magnifier	Hand or tripod type
Medicine droppers	
Meter stick	Squares ruled in English and metric system
Microscope Standard for demonstration use	Double objective up to 440X power
Mirrors	Concave, set Convex, set Plane (4" x 6" recommended as minimum)
Models	Human, such as ear, eye, or heart
Pith balls	
Plumb Bob	
Prism, equilateral	Glass 25 x 100 mm or approximate size
Pulleys	Double, single, or triple sheave
Pump, liquid	Plastic or non-breakable
Ring stands	Assorted
Rubber stoppers	Assorted sizes
Rubber tubing	3/16" diameter, 1/16" non-expandable items or selected to fit glass tubing
St. Louis Motor	
Switch, knife blade type	Single pole — single throw

Terrarium	18" x 10" x 16" recommended
Test tube brush	
Test tube clamp	Wire
Test tube rack	
Test tubes, pyrex	25 x 150 mm 25 x 200 mm
Thermometer	Centigrade 110 degrees C Fahrenheit 220 degrees F
Tripod	Iron burner stand
Tubing, capillary	
Weather instrument for teacher's desk	Includes barometer, hygrometer and thermometer
Weight hanger	
Weights	Hooked, 10 gm — 1000 gms Slotted 1 gm — 500 gms
Wire	Coil of iron and coil of insulated copper, 20 guage
Yardstick	
Audio-visual equipment	Including motion picture projector, filmstrip and slide projector, screen, filmstrips, films, and other audio-visual equipment

For other equipment and materials in enriching elementary science, see the Title III, NDEA Science List for elementary schools. The above list does not include consumable materials. A great variety of materials may be obtained locally at little or no cost when advance preparation is made.

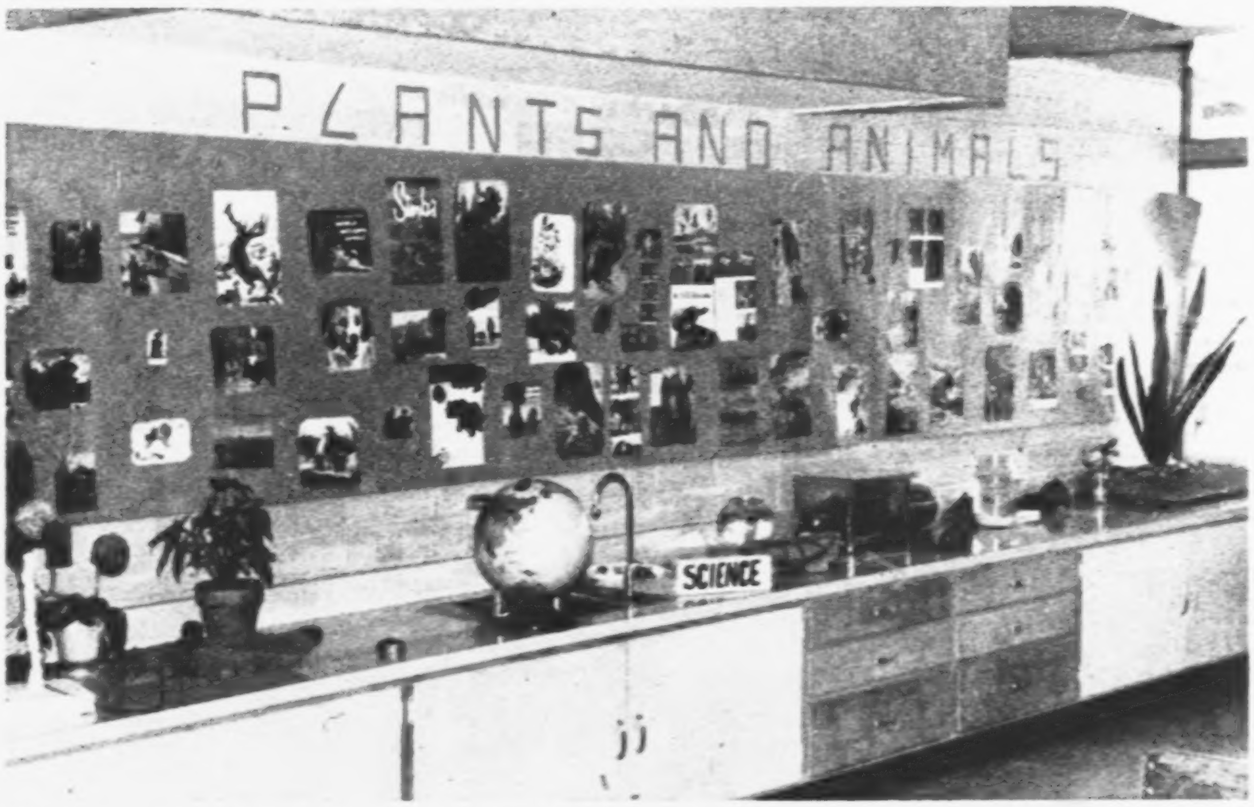
The above list is essentially the same as the list printed in Mississippi School Bulletin No. 150 (Title III, NDEA).

CHAPTER 4

PHOTOGRAPHS OF ELEMENTARY SCHOOL SCIENCE FACILITIES

WEST END ELEMENTARY SCHOOL

Meridian, Mississippi



Wall counter table with cabinets provide work spaces, storage and display space. Cork board on the wall provides for display of pictures and printed materials.

Closer view of the same facilities.

RICHLAND ELEMENTARY SCHOOL

Rankin County, Mississippi

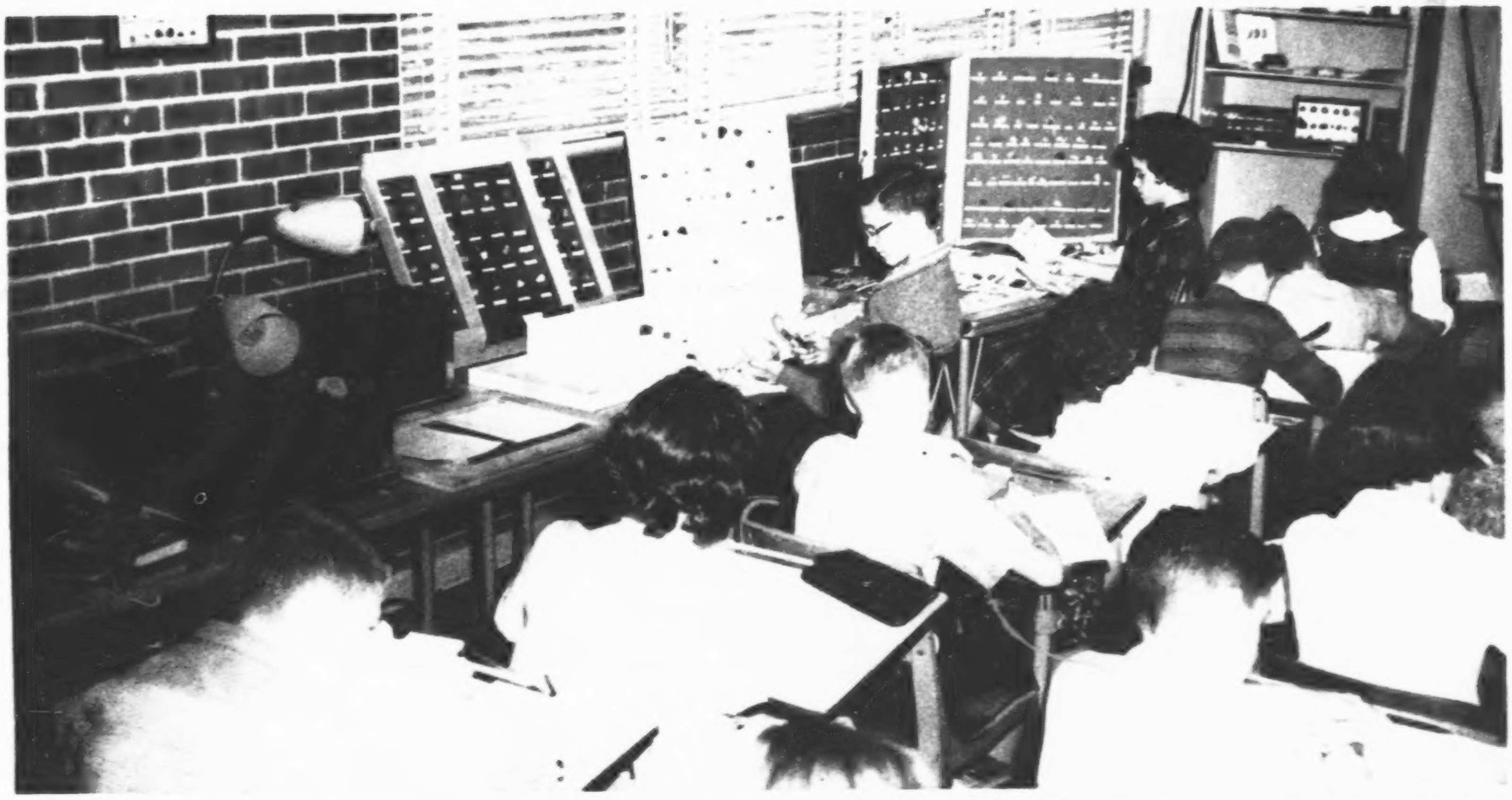
Science in grades 6, 7, and 8 are taught by a teacher trained in science. Minor remodeling was done to provide work stations to include:

1. A well-lighted table for microscope use
2. Tables for experiments in chemistry or general science
3. Area with telescope and other equipment in earth science. The teacher uses a portable demonstration desk.

A reconverted science table in use by 7th grade pupils at Richland.

Germinating bed and aquarium in use by 6th grade pupils, Richland.

McWILLIE ELEMENTARY SCHOOL
Jackson, Mississippi



Rock and mineral displays are arranged on tables, wall and cabinet at the side of this sixth grade classroom at McWillie School. These are exhibited during the study of the earth science unit. Students are motivated by the displays and take pride in their own collection. Note the stocked aquarium jars, too.

Students work with their collections at the back of the same room shown above. Earth science posters similar to ones seen on the wall are exhibited in the corridor during the study of the earth science unit.

CHAPTER 5

ELEMENTARY SCHOOL SCIENCE FACILITIES
TWENTY POINT CHECK LIST FOR A SCIENCE ROOM[7]

Editor's note: Here an elementary science supervisor gives some help on evaluating a science room. Although many schools do not have separate rooms set aside for science teaching, this check list will be helpful in checking the science part of any self-contained classroom. Many of the items suggest activities that are appropriate in any room where science learning takes place. For example: have you considered having a live animal zoo (item 6)? or a science reference shelf (item 14)? or a collection of science pictures (item 15)?

1. Is the science room the high spot of the school?

2. Is a fifth or sixth grade class assigned primary responsibility in: (a) planning, (b) arranging, (c) running the science room?

3. Do the children enter the room faster than they leave? Is the room a merry one with eye and nose appeal?

4. Does it have a "touch and try" section where the children can study:

plants
animals
foods
air
weather
water
soil
rocks
toys
chemicals
machines
sound
heat
light
electricity
building and clothing materials

5. Does it have a work table, tools, and construction materials like

wire
string
rubber bands
paper fasteners
tacks
round pencils
spools
cardboard
empty containers
candy boxes
hair pins
cement
scotch tape

for the assembling of simple projects?

6. Does it have a "live animal zoo?"

a. Housed in natural habitat as far as possible?

b. Fed, watered, and cleaned at proper intervals by the children?

c. Simply labelled in large type?

d. Characteristics described by stories and drawings created by the children?

e. Provided for on week ends and holidays?

f. Protected against mishandling by acquainting the children with the proper handling of animals?

7. Does it have its own "botanic garden" featuring:

a. Live displays of plants and flowers in season?

b. Woodland scenes of ferns, mosses, and lichens?

c. Plants grown at home by the children (sweet potato, beans, grapefruit, carrot, etc.)?

8. Does it have a museum?

a. Colorfully displayed?

b. Carefully spaced?

c. Clearly labelled?

Does the museum feature:

a. Diorama scenes made by the children?

b. Dioramas borrowed from a local museum?

c. Models constructed on a table top showing farm, jungle, eskimo, factory, or similar scenes?

9. Does it have a bulletin board? Is it:

a. Changed periodically as seasons, topics or interests vary?

b. Decorated with the children's own science art work?

c. Used to display children's questions and answers?

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[7] Milgram, Harry. **Elementary School Science Bulletin** National Science Teachers Association, No. 9 (February 1954), p. 3. Permission granted for use of this material.

10. Does it have a quiz section consisting of

a. Electrical games?

b. Identifications?

c. Riddles?

d. Picture puzzles?

11. Does the room have an imaginative play corner, outfitted with homemade devices simulating a:

a. Fire engine?

b. Derrick?

c. Space port?

d. Locomotive cab?

e. Radio or television studio?

f. Research laboratory?

g. Mountain observatory?

h. Weather station?

12. Is the school science equipment stored in the room? Is it:

a. Provocatively displayed?

b. Readily accessible to the teachers?

c. Catalogued?

13. Are the displays integrated with class activities of:

a. Seasonal

b. Topical

interests?

14. Does it have a reference shelf, indexed according to topics to facilitate "looking up" by children?

15. Does it have a collection of science pictures, indexed according to subject matter?

16. Does it feature a toy corner where the science implications of:

a. Magnetic toys (Scottie dogs on magnets)

b. Wind-up toys (cars, locomotives)

c. Boats and planes (submarine, jet balloon), may be studied?

17. Does it publish a science bulletin written by the children to describe their experiments and findings?

18. Are safety precautions prominently featured and stressed with respect to:

a. Use of tools?

b. Handling of animals?

c. Use of chemicals and heat?

19. Do the children at work in the room:

a. Show genuine interest?

b. Set up their own problems?

c. Become more and more curious?

20. Is the teacher assigned to supervise the activities, eager to explore the world of science in full partnership with the children?

APPENDICES

APPENDIX A

A CHECK LIST OF FACILITIES FOR TEACHING GENERAL SCIENCE IN GRADES 7, 8, AND 9[7]

Yes No

1. Has adequate space (approximately 40 square feet per pupil in the classroom—laboratory and 10 square feet per pupil in the storage, preparation, and darkrooms) been provided for pupils to have many kinds of experiences in science? ____ ____
2. Has sufficient number of classroom-laboratories been provided to enable each general science class to meet in a classroom-laboratory? ____ ____
3. Have floors been provided that meet the following conditions?
   - a. Non-slippery when wet ____ ____
   - b. Resistant to action of cleaning agents ____ ____
   - c. Attractive in color ____ ____
   - d. Made of material that is free from unnecessary polish to provide safety and to prevent excessive glare ____ ____
4. Do the walls and ceilings meet the following specifications?
   - a. Attractive in color ____ ____
   - b. Acoustically appropriate ____ ____
   - c. Finished with paint that does not contain lead or chrome pigments which darken with age ____ ____
5. Is the room adaptable to experiences in both the physical and the biological sciences? ____ ____
6. Is the room adaptable to use by other high school classes such as mathematics? ____ ____
7. Does the demonstration desk meet the specifications outlined below?
   - a. A working surface of approximately 20 square feet ____ ____
   - b. Acid and heat-resistant top ____ ____
   - c. Sink, trap, and disposal lines that are resistant to the action of strong chemicals ____ ____
   - d. 110 volt alternating current ____ ____
   - e. Direct current ____ ____
   - f. Running water, both hot and cold ____ ____
   - g. Duplex gas outlet ____ ____
   - h. Several drawers and a cupboard ____ ____
   - i. Upright bars ____ ____
8. Is the demonstration desk located in such a position that all pupils can see the demonstrations with difficulty? ____ ____

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[7] McCollum, op. cit.

9. Have movable tables or tablet arm chairs of varying heights been provided? ____ ____

   If tablet arm chair have been provided, have provisions been made for left-handed pupils? ____ ____

10. Has a sufficient number of laboratory tables been provided to afford ample working area for pupils to participate in small group activities? (The laboratory tables will not be necessary if movable student tables have been provided in place of tablet arm chairs.) ____ ____

11. Are the projectors listed below available for use in the science program?

    a. 16 mm sound motion picture projector ____ ____

    b. Filmstrip projector ____ ____

    c. Slide projector ____ ____

    d. Microprojector ____ ____

12. Have the following provisions been made for efficient utilization of the projectors?

    a. Facilities for adequate darkening of the room. (This may call for dark shades or draperies.) ____ ____

    b. Electrical outlets located at planned work areas in the room ____ ____

    c. A suitable screen ____ ____

13. Have the following facilities been provided for printed materials?

    a. Bookcase or shelves ____ ____

    b. Magazine rack ____ ____

    c. File for bulletins, pamphlets, etc. ____ ____

14. Have the facilities which follow been provided for display purposes?

    a. Display case(s), shelves, and/or table ____ ____

    b. A minimum of 12 linear feet or 42 square feet of tackboard ____ ____

    c. Tracks above chalkboard ____ ____

    d. A stand or rack for charts ____ ____

15. Does the display case possess the following desirable features?

    a. Glass doors and shelves ____ ____

    b. Adequate interior lighting ____ ____

    c. Electrical outlet and switch for operating exhibited devices requiring electricity ____ ____

16. In providing running water, have the following provisions been made?

    a. Faucets of the slow-compression type ____ ____

    b. Working parts of metal resistant to corrosion and abrasion ____ ____

    c. Some faucets fitted with serrated hose connection ____ ____

    d. Hot water at one location in the room, preferably the demonstration table ____ ____

17. Have the following provisions been made for reasons of safety?

    a. Electrical outlets located in such a position that water cannot enter them ____ ____

    b. Master switch for electrical circuits ____ ____

    c. Grounding of any electrical circuit with a potential of more than 25-V, a.c. ____ ____

d. Arrangement of motors, generators, and switchboards so that pupils are protected ____ ____

e. Fire extinguisher ____ ____

f. Asbestos blanket ____ ____

g. First-aid kit ____ ____

h. Prominently placed shut-off valves for gas and water lines ____ ____

i. Sturdy chairs, tables, and other furniture ____ ____

j. A storage cabinet which can be locked for the storage of dangerous chemicals ____ ____

k. Steel cabinets for storage of inflammable chemicals ____ ____

18. In addition to providing the utilities listed below at the demonstration table, have they been provided in at least one other area in the laboratory?

a. Gas ____ ____

b. 110-V alternating current ____ ____

c. Running water ____ ____

d. Acid-resistant sink and disposal lines ____ ____

19. Have earthenware crocks been provided for the disposal of plant and animal wastes?

20. Have the following facilities been provided in each classroom laboratory?

a. Terrarium ____ ____

b. Aquarium ____ ____

c. Germinating bed ____ ____

21. Have provisions been made for using radio in teaching science? ____ ____

22. Have provisions been made for using television in teaching science? ____ ____

23. Has a mobile demonstration desk or cart of the same height as the stationary demonstration desk been provided which can be used for such purposes as setting up demonstration materials for use during the day, additional laboratory space for pupil work, display purposes, projector table, and for use in the elementary school? ____ ____

24. Has adequate chalkboard been provided? (A minimum of sixteen linear feet) ____ ____

25. Has storage room been provided? ____ ____

26. Are shelves in the storage room adjustable for maximum utilization of space? ____ ____

27. Have storage facilities been provided which separate chemicals from apparatus? ____ ____

28. Has a dust proof cabinet been provided for the storage of microscopes? ____ ____

29. Have plans been made for satisfactory storage of the following teaching materials?

a. Charts ____ ____

b. Films and filmstrips ____ ____

c. Projects that may be valuable teaching aids ____ ____

30. Has a preparation room been provided which serves as a workroom for the teacher and for pupil experimentation and project work? ____ ____

31. Have the following facilities been provided in the preparation room? ____ ____

a. A work table with sink and lines made of materials that resist the action of strong chemicals ___ ___

b. Running water ___ ___

c. Duplex gas outlet ___ ___

d. Electrical outlets ___ ___

e. Adequate illumination ___ ___

f. Adequate ventilation ___ ___

g. Storage space ___ ___

32. Has a darkroom been provided for such activities as work in photography, micro-projection, etc.? ___ ___

33. Does the darkroom contain the following?

a. A developing table with this equipment:

(1) A sink ___ ___

(2) Hot and cold water ___ ___

(3) Gas ___ ___

(4) 110 volt a. c. outlet ___ ___

b. Wall cabinet above developing table ___ ___

c. A printing table ___ ___

34. Has space been provided for a desk and filing cabinet so that the teacher may lock classroom records, file materials, prepare instructional material during his preparation period, and hold parent-pupil conferences? ___ ___

*35. Are microscopes readily available in the room? ___ ___

* Addendum to quoted material.

APPENDIX B

A CHECK LIST OF FACILITIES FOR TEACHING BIOLOGY[8]

1. Has adequate space (approximately 40 square feet per pupil in the classroom-laboratory and 10 square feet per pupil in the storage, preparations, and dark rooms) been provided for pupils to engage in many types of activities? .... ____ ____
2. Has a sufficient number of classroom-laboratories been provided to enable each biology class to meet in a classroom-laboratory? .... ____ ____
3. Do the floors meet the following conditions?
   a. Non-slippery when wet .... ____ ____
   b. Resistant to the action of cleaning agents .... ____ ____
   c. Attractive in color .... ____ ____
   d. Made of material that is free from unnecessary polish to provide for safety and to prevent excessive glare .... ____ ____
4. Do the walls and ceilings meet the following specifications?
   a. Attractive in color .... ____ ____
   b. Acoustically appropriate .... ____ ____
   c. Finished with paint that does not contain chrome or lead pigments which darken with age .... ____ ____
5. Has a demonstration desk with the following facilities been provided?
   a. A working surface of approximately 20 square feet .... ____ ____
   b. Duplex receptacle of the pedestal type on the working surface and duplex flush receptacles on the back and each side for alternating current .... ____ ____
   c. A top that is acid and heat-resistant .... ____ ____
   d. Sink, trap, and disposal lines that are resistant to the action of strong chemicals .... ____ ____
   e. Sink strainer .... ____ ____
   f. Running water, both hot and cold .... ____ ____
   g. A duplex gas outlet .... ____ ____
6. Is the demonstration desk located in a position that will enable all pupils to see the demonstrations without difficulty? .... ____ ____
7. Have one or two-student movable tables or tablet arm chairs been provided for pupil use? .... ____ ____
8. If tablet arm chairs have been provided, are laboratory tables available for laboratory work? .... ____ ____

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[8] Ibid.

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9. In addition to providing the utilities listed below at the demonstration table, have they been provided in at least three other areas in the laboratory?
    a. Gas ____ ____
    b. 110 volt alternating current ____ ____
    c. Running water ____ ____
    d. Acid-resistant sink and disposal lines ____ ____
10. Has adequate chalkboard been provided? (A minimum of 16 linear feet) ____ ____
11. Are the projectors listed below available for use in teaching biology?
    a. 16 mm sound motion picture projector ____ ____
    b. Filmstrip projector ____ ____
    c. Slide projector ____ ____
    d. Opaque projector ____ ____
    e. Microprojector ____ ____
12. Have the following provisions been made for use of the projectors?
    a. Facilities for adequate darkening of the room. This may call for dark shades or draperies.) ____ ____
    b. Electrical outlets placed at planned work areas in the room ____ ____
    c. A suitable screen ____ ____
13. Have the following facilities been provided in each classroom-laboratory?
    a. Terrarium ____ ____
    b. Aquarium ____ ____
    c. Germinating bed ____ ____
14. Have the following facilities been provided for printed materials?
    a. Bookcase or shelves ____ ____
    b. Magazine rack ____ ____
    c. File for bulletins, pamphlets, etc. ____ ____
15. Have the facilities which follow been provided for display purposes?
    a. Display case(s), shelves, and/or table ____ ____
    b. A minimum of 12 linear feet or 42 square feet of tackboard ____ ____
    c. Tracks above chalkboard ____ ____
    d. A stand or rack for charts ____ ____
16. Does the display case possess the following desirable features?
    a. Glass doors and shelves ____ ____
    b. Adequate interior lighting ____ ____
    c. Electrical outlets and switches for operating exhibited devices requiring electricity ____ ____
17. Have display cases for museum specimens been planned to avoid excessive heat so that excessive evaporation of preserving fluids does not occur and the melting or drying out of sealing compounds on museum jars is reduced? ____ ____

18. In providing running water, have the following provisions been made?
   a. Faucets of slow-compression type
   b. Working parts of metal resistant to corrosion and abrasion
   c. Some faucets fitted with serrated hose connection
   d. Hot water at one location in the room, preferably the demonstration table

19. Have provisions for adequate ventilation been made to remove from the room obnoxious odors from plant and animal specimens, formaldehyde fumes, etc.?

20. Have covered earthenware crocks been provided in the classroom for disposal of plant and animal wastes?

21. Are sufficient electrical outlets available to provide the illumination needed for the close work called for in biology? (Supplemental lighting may be necessary for microscopic work, the exhibit cases, the area where aquaria and vivaria are kept, etc.)

22. Has one sink with pegboard been provided for cleaning and drying glassware?

23. Has a wall counter on the window side of the room been provided?

24. Have the following facilities been provided on the wall counter?
   a. Acid-proof and fire-proof finish
   b. Electrical outlets
   c. Gas outlets
   d. One or more sinks
   e. Storage shelves beneath the counter

25. If a room for maintaining plants and animals is a part of the biology facilities, have the provisions which follow been made?
   a. Maintenance of constant temperature
   b. Adequate ventilation
   c. Storage for food, peat moss, and other related supplies
   d. Sink with hot and cold water
   e. Water outlets with hose fittings

26. Have the provisions which follow been made for reasons of safety?
   a. Outlets placed in a position so that water will not enter them
   b. Master switches for electrical circuits
   c. Grounding of any electrical circuit with a potential of more than 25-V, A. C.
   d. Arrangement of motors, generators, and switchboards so that pupils are protected
   e. Fire extinguisher
   f. Asbestos blanket
   g. First-aid cabinet
   h. Prominently placed shut-off valves for gas and water lines
   i. Sturdy chair, tables, and other furniture

j. A storage cabinet which can be locked for storing dangerous chemicals ____ ____

27. Has a storage room been provided? ____ ____

28. Are shelves in the storage room adjustable for maximum utilization of space? ____ ____

29. Has a dust-proof cabinet been provided for the storage of microscopes? ____ ____

30. Have provisions been made for satisfactory storage of the following teaching materials?

   a. Charts ____ ____

   b. Films and filmstrips ____ ____

   c. Slides ____ ____

   d. Projects that may be valuable teaching aids ____ ____

31. Has a lead-lined cabinet been supplied for the storage of inflammable chemicals? ____ ____

32. Has a preparation room been provided which serves as a workroom for the teacher and for pupil experimentation and project work when the classroom-laboratory is being used? ____ ____

33. Have the following facilities been provided in the preparation room?

   a. Adequate table space ____ ____

   b. Sink and lines made of materials that will resist the action of strong chemicals ____ ____

   c. Running water ____ ____

   d. Duplex gas outlets ____ ____

   e. Electricity ____ ____

   f. Storage space for some equipment and supplies ____ ____

   g. Earthenware crocks ____ ____

   h. Adequate illumination ____ ____

   i. Adequate ventilation ____ ____

34. Has a darkroom been provided for such activities as work in photography, microprojection, etc.? ____ ____

35. Have the following facilities been provided in the darkroom?

   a. A developing table with

      (1) A sink ____ ____

      (2) Water, both hot and cold ____ ____

      (3) Duplex gas outlets ____ ____

      (4) 110 volt A. C. outlet ____ ____

   b. Wall cabinet above developing table ____ ____

   c. A printing table ____ ____

   d. Adequate ventilation ____ ____

36. Has space been provided for a desk and filing cabinets so the teacher may lock classroom records, file materials, prepare instructional material during his preparation period, and hold parent-pupil conferences? ____ ____

*37. Are there 15 or more good microscopes available?

*38. Have towel and soap dispensers been installed? ____ ____

*39. Is there at least one three dimensional microscope (binocular-stereo.) available for every 8 pupils? ____ ____

*Addenda to quoted material.

APPENDIX C

A CHECK LIST OF FACILITIES FOR TEACHING CHEMISTRY[9]

1. Has adequate space (approximately 40 square feet per pupil in the classroom-laboratory and 10 square feet per pupil in the storage, preparation, and darkrooms) been provided for pupils to engage in many types of activities? —— ——

2. Have floors been provided that meet the following conditions?

   a. Acid-resistant —— ——

   b. Non-slippery when wet —— ——

   c. Resistant to the action of cleaning agents —— ——

   d. Attractive in color —— ——

   e. Made of material that is free from unnecessary polish to provide for safety and to prevent excessive glare —— ——

3. Do the walls and ceilings meet the following specifications?

   a. Attractive in color —— ——

   b. Acoustically appropriate —— ——

   c. Finished with a paint that does not contain lead or chrome pigments which darken with age —— ——

4. Has a demonstration desk with the following facilities been provided?

   a. Approximately 20 square feet of working surface area —— ——

   b. Duplex receptacle of the pedestal type on the working surface, and duplex flush receptacles on the back and each side for alternating current —— ——

   c. A top that is acid and heat-resistant —— ——

   d. Sink, trap, and disposal lines that are resistant to the action of strong chemicals —— ——

   e. Hot and cold running water —— ——

   f. Duplex gas outlet —— ——

   g. Several drawers and a cupboard —— ——

   h. Upright bars especially if the room is to be used for chemistry and physics —— ——

   i. A sink strainer —— ——

5. Is the demonstration desk located in a position which will allow all pupils to see the demonstration without difficulty? —— ——

6. Has a sufficient number of laboratory tables been provided to permit pupils to work in groups of two? —— ——

7. Have the following facilities been planned for the laboratory tables?

a. Sinks, traps, fixtures, and disposal lines that are resistant to the action of strong chemicals ____ ____

b. A strainer for each sink ____ ____

c. Running water ____ ____

d. Gas ____ ____

e. Electricity ____ ____

f. Sufficient storage space to serve anticipated number of sections ____ ____

8. Have arm chairs been provided for activities other than laboratory work? ____ ____

Have provisions been made for left-handed pupils? ____ ____

Have provisions been made for differences in heights of pupils? ____ ____

9. Are the projectors listed below available?

a. 16 mm sound motion picture projector ____ ____

b. Filmstrip projector ____ ____

c. Slide projector ____ ____

d. Opaque projector ____ ____

e. Microprojector ____ ____

10. Have the following provisions been made for use of the projectors?

a. Facilities for adequate darkening of the room (This may call for dark shades or draperies.) ____ ____

b. Electrical outlets placed at convenient locations in the room ____ ____

c. A suitable screen ____ ____

11. With reference to electrical facilities, have the following conditions been met?

a. Provision for 30 amperes for general purpose circuits, lighting fixtures, dark room receptacles, and wall receptacles ____ ____

b. Provision for a minimum of 30 amperes for the demonstration desk and the preparation room desk ____ ____

c. A circuit with a duplex receptacle provided for each four pupils and separate fuses for each circuit ____ ____

d. D. C. provided at the demonstration desk ____ ____

12. Has a minimum of 16 linear feet of chalkboard been provided? ____ ____

13. Have the following provisions been made in the interest of safety?

a. Electrical outlets placed in such a position that water will not enter them ____ ____

b. Master switches for electrical circuits ____ ____

c. Grounding of any electrical circuit with a potential of more than 25-V, A. C. ____ ____

d. Arrangement of motors, generators, and switchboards so that pupils are protected ____ ____

e. Fire extinguisher ____ ____

f. Asbestos blanket ____ ____

g. First-aid cabinet ____ ____

h. Prominently placed shut-off valves for gas and water lines

i. Sturdy chairs, tables, and other furniture

j. A storage cabinet which can be locked for storing dangerous chemicals

k. Inflammable chemicals stored in a fire proof cabinet

14. Has adequate ventilation been provided to remove obnoxious, harmful gases from the room?

15. If a fume hood has been provided, have the following provisions been made?

a. Exhaust fan

b. Non-corrodible ducts lead directly outside

16. In ventilating the room, have provisions been made so that air from the chemistry room will not be recirculated in the school building?

17. Have the following facilities been provided for printed material?

a. Bookcase or shelves

b. Magazine rack

c. File for bulletins, pamphlets, etc.

18. Have the following display facilities been provided?

a. Display cases(s) and/or shelves

b. A minimum of 12 linear feet or 42 square feet of tackboard

c. Tracks above chalkboard

d. Stand or rack for charts

19. Does the display case provide these facilities?

a. Glass doors and shelves

b. Adequate interior lighting

c. Outlets and switches for operating exhibited devices requiring electricity

20. Has a water still been provided in order that distilled water may be available for use in experiments and for the preparation of solutions?

21. In providing running water, have the following provisions been made?

a. Faucets of slow-compression type

b. Working parts of metal resistant to corrosion and abrasion

c. Some faucets fitted with serrated hose connection

d. Hot water at one location in the room, preferably the demonstration table

22. Have provisions been made for the use of radio in teaching chemistry?

23. Have provisions been made for the use of television in teaching chemistry?

24. Has a laboratory cart been provided which can be used for such purposes as setting up materials for demonstration purposes, display purposes, projector table, etc.?

25. Is adequate space, as indicated below, provided for storage of chemicals, equipment, and materials?

a. A minimum of 125 square feet storage to serve one chemistry laboratory

b. A minimum of 150 square feet of storage to serve two chemistry laboratories

c. When a storage room serves a chemistry-physics laboratory, a minimum of 150 square feet of storage for the chemistry-physics laboratory

d. Approximately 84 feet of shelving

26. Have adjustable shelves been installed in the storage room?

27. Have separate storage areas been provided for chemicals and apparatus?

28. Has continuous ventilation been provided for stored chemicals?

29. Have plans been made for satisfactory storage of the following teaching materials?

a. Charts

b. Films and filmstrips

c. Projects that may be valuable teaching aids

30. Have provisions been made for the safe storage of expensive, delicate equipment? (This includes dust proof storage facilities for microscopes.)

31. Has a preparation room been provided which serves as a workroom for the teacher and for pupil experimentation and project work?

32. Have the following facilities been provided in the preparation room?

a. A work table with

(1) Sink and lines made of materials that will resist the action of strong chemicals

(2) Acid and heat-resistant top

b. Running water

c. Duplex gas outlet

d. Electrical outlets

e. Adequate ventilation

f. Adequate illumination

g. Storage space

33. Has a darkroom been provided for such activities as work in photography, microprojection, etc.?

34. Have the facilities which are listed below been provided in the darkroom?

a. A developing table with

(1) Sink

(2) Hot and cold water

(3) Duplex gas outlets

(4) 110 volt A. C. outlet

b. Wall cabinet above developing table

c. A printing table

d. Adequate ventilation

35. Has space, separate from the classroom, been provided for a desk and filing cabinet so that the teacher may lock classroom records, file materials, prepare instructional material during his preparation period, and hold parent and pupil conferences?

APPENDIX D

A CHECK LIST OF FACILITIES FOR TEACHING PHYSICS[10]

1. Has adequate space (approximately 40 square feet per pupil in the classroom-laboratory and 10 square feet per pupil in the storage, preparation, and darkrooms) been provided for pupils to engage in many types of activities? ___ ___
2. Do the floors meet the following standards?
    - a. Acid-resistant ___ ___
    - b. Non-slippery when wet ___ ___
    - c. Resistant to the action of cleaning agents ___ ___
    - d. Attractive in color ___ ___
    - e. Made of material that is free from unnecessary polish to provide for safety and to prevent excessive glare ___ ___
3. Do the walls and ceilings meet the following specifications?
    - a. Attractive in color ___ ___
    - b. Acoustically appropriate ___ ___
    - c. Painted with a paint that does not contain lead or chrome pigments which darken with age ___ ___
4. Has a demonstration desk been provided which contains the following facilities?
    - a. Approximately 20 square feet of working surface area ___ ___
    - b. Duplex receptacle of the pedestal type on working surface, and duplex flush receptacles on the back and each side for alternating current ___ ___
    - c. A top that is acid and heat-resistant ___ ___
    - d. Sink, trap, and disposal lines that are resistant to the action of strong chemicals ___ ___
    - e. Hot and cold running water ___ ___
    - f. A duplex gas outlet ___ ___
    - g. Several drawers and a cupboard ___ ___
    - h. Outlets for direct current ___ ___
    - i. Upright bars ___ ___
5. Is the demonstration desk located in a position which will allow all pupils to see the demonstration without difficulty? ___ ___
6. Has a sufficient number of laboratory tables been provided to permit pupils to work in groups of two? ___ ___

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[10] Ibid.

7. If movable tables are to be placed in the physics room, have provisions been made for electricity? (If floor boxes are used, they must be placed in sub-floor channels which are free from flooding.) ____ ____

8. Have tablet arm chairs been provided for activities other than laboratory work? ____ ____
   a. Have provisions been made for left-handed pupils? ____ ____
   b. Have provisions been made for differences in heights of pupils? ____ ____

9. Has a minimum of 16 linear feet of chalkboard been provided? ____ ____

10. Have the projectors listed below been provided?
    a. 16 mm sound motion picture ____ ____
    b. Filmstrip projector ____ ____
    c. Slide projector ____ ____
    d. Opaque projector ____ ____

11. Have the following provisions been made for use of the projectors?
    a. Facilities for adequate darkening of the room (This may call for dark shades or draperies.) ____ ____
    b. Electrical outlets placed at convenient locations in the room ____ ____
    c. A suitable screen ____ ____

12. Have the following provisions been made in the interest of safety?
    a. Electrical outlets placed in such a position that water will not enter them ____ ____
    b. Master switches for electrical circuits ____ ____
    c. Grounding of any electrical circuit with a potential of more than 25-V, A. C. ____ ____
    d. Arrangements of motors, generators, and switchboards so that pupils are protected ____ ____
    e. Fire extinguisher ____ ____
    f. Asbestos blanket ____ ____
    g. First-aid cabinet ____ ____
    h. Prominently placed shut-off valves for gas and water lines ____ ____
    i. A storage cabinet which can be locked for storing dangerous chemicals ____ ____
    j. Inflammable chemicals stored in steel cabinets ____ ____
    k. Sturdy chairs, tables, and other furniture ____ ____

13. With reference to electrical facilities, have the following conditions been met?
    a. Provision for D. C. at the demonstration desk and several other areas in the room ____ ____
    b. A separate circuit provided for lighting the display case and for the operation of any electrical apparatus exhibited in the case ____ ____
    c. A circuit with a duplex receptacle provided for each four pupils and separate fuses for each circuit ____ ____
    d. Switchboard and fuse panel readily accessible to the teacher ____ ____
    e. Provision for locking the switchboard and fuse panel ____ ____

14. Have the facilities which follow been provided for display purposes?
    a. Display case(s) and/or shelves
    b. A minimum of 12 linear feet of tack board or 42 square feet
    c. Tracks above chalkboard
    d. Stand or rack for charts
15. Does the display case provide these facilities?
    a. Glass doors and shelves
    b. Adequate interior lighting
    c. Switch for operating exhibited devices
    d. Electrical outlets readily accessible
16. Have the following facilities been provided for printed material?
    a. Bookcase or shelves
    b. Magazine rack
    c. File for bulletins, pamphlets, etc.
17. In providing running water, have the following provisions been made
    a. Faucets of slow-compression type
    b. Working parts of metal resistant to corrosion and abrasion
    c. Some faucets fitted with serrated hose connection
    d. Hot water at one location in the room, preferably the demonstration desk
18. Has a mobile table or cart been provided which can be used for such purposes as setting up materials for demonstration purposes, display purposes, projector table, etc.?
19. Have provisions been made for the use of radio in the physics course?
20. Have provisions been made for the use of television in the physics course?
21. Is adequate space, as indicated below, provided for storage of chemicals, equipment, and materials?
    a. A minimum of 125 square feet of storage space to serve one physics laboratory
    b. A minimum of 150 square feet of storage space to serve two physics laboratories
    c. A minimum of 150 square feet of floor area to serve a chemistry-physics laboratory
22. Have separate storage areas been provided for chemicals and apparatus?
23. Have adjustable shelves been installed in the storage room?
24. Have plans been made for satisfactory storage of the following teaching materials?
    a. Charts
    b. Films and filmstrips
    c. Projects that may be valuable teaching aids

25. Have provisions been made for the safe storage of expensive, delicate equipment? ____ ____

26. Has a preparation room been provided which serves as a workroom for the teacher and for pupil experimentation and project work? ____ ____

27. Have the following facilities been provided in the preparation room?

    a. A work table with

        (1) Sink and lines made of materials that will resist the action of strong chemicals ____ ____

        (2) Acid and heat-resistant top ____ ____

    b. Running water ____ ____

    c. Duplex gas outlet ____ ____

    d. Electrical outlets ____ ____

    e. Adequate illumination ____ ____

    f. Adequate ventilation ____ ____

    g. Storage space ____ ____

28. Has a darkroom been provided for such activities as work in photography, microprojection, etc.? ____ ____

29. Have the facilities which are listed below been provided in the darkroom?

    a. A working table with

        (1) Sink and lines made of materials that will resist the action of strong chemicals ____ ____

        (2) Hot and cold water ____ ____

        (3) Duplex gas outlets ____ ____

        (4) 110 volt A. C. outlet ____ ____

    b. Running water ____ ____

    c. Duplex gas outlet ____ ____

    d. Electrical outlets ____ ____

    e. Adequate illumination ____ ____

    f. Adequate ventilation ____ ____

    g. Storage space ____ ____

30. Has space, separate from the classroom, been provided for a desk and filing cabinet so that the teacher may lock classroom records, file materials, prepare instructional material during his preparation period, and hold parent-pupil conferences? ____ ____

*31. Has a separate mobile cart or table of proper height been provided for transporting vacuum pump and motor assembly?

*Addendum to quoted material.

APPENDIX E

SCIENCE TEACHERS' OPINIONS as REVEALED by QUESTIONNAIRE

Thirteen members of the National Science Foundation Summer Institutes (1960), representing all three Institutes in Mississippi at that time, expressed their opinions in conference with the State Supervisor of Science and through the medium of response to a questionnaire. This section represents a summary of responses to the questionnaire.

A. Relative Importance of Laboratory Facilities

The science teachers were asked to rate given facilities with regard to the importance of the facility to science instruction. They were asked to rate each one either as (1) Absolutely Essential, (2) Very Desirable, (3) Useful, (4) Not Needed.

According to the composite rating by the group, the items would classify as shown under respective headings. The number of the item indicates the number of teachers assigning the item to that column. Obviously, the larger the number the more significant would be the rating.

1. Absolutely Essential
    - AC Current—12
    - DC Current—7
    - Gas Outlets—13
    - Water Outlets with Sink—13
    - Wash-up Sink—7
    - Bulletin Board—9
    - Chalk Board—12
    - Black Out Shades—6
    - Fume Hood (Chem.)—12
    - Wall Storage Cabinets—8
    - Work Tables or Counter Work Area—9
    - Special Storage Room—11
    - Book Shelves—5
    - Teacher's Demonstration Desk in Lecture Room—11
    - Teacher's Demonstration Desk in Lab—9
2. Very Desirable
    - Teachers File and Storage—7
    - Film and Filmstrips Projectors—7
    - Wall Screen—7
    - Chart Racks—8
    - Terrarium—10
    - Aquarium—8
    - Germinating beds—7
    - Exhibit Cases—10
    - Preparation Room—8
    - Dark Room—8
    - Special Projects and Work Room—6
    - Laboratory Cart—5
    - Periodical Display Rack—7
    - Microscope Case—5
3. Useful
    - Notebook Case—11
    - Key Case—8
    - Plant Room or Green House—6
    - Fume Hood for Gen. Sci.—6
    - Analytical Balance Room (Chem.)—5
4. Not Needed—0

B. Preferences in Types of Laboratory Tables and Arrangements.

As a matter of preference teachers choose:

1. If the lab is separate, I would prefer
   - a. Tables spaced throughout room 9
   - b. Peripheral arrangement 4
2. In a combined lec.-lab room, I would prefer
   - a. Chairs and tables at opposite ends of the room 7
   - b. The perimeter arrangement 5
3. As a choice of types of tables, I would prefer 4 students tables approximately 4x6 8
   (over the 2-6-or-8-student tables)
4. I would prefer
   - a. Separate lecture-lab rooms 9
   - b. Combined lecture - lab rooms 4
5. If there are to be two labs at school, I would group
   - a. Chem-physics and biology gen. sci. 9
   - b. Chem-biol. and gen. sci.-physics 1
   - c. Chem-gen. sci. and biol.-physics 3
6. For biol.-gen. sci. lab, I prefer
   - a. Tables fully equipped with gas, water, and electricity 11
   - b. The sturdy acid resistant, biology-type table with no connections, but a certain number of sinks, electrical and gas outlets in wall counter 2
7. For chem.-physics, I prefer
   - a. A center sink table with all utilities 11
   - b. Standard physics table in one part of the room with the tall, conventional chem. table in other part of room 2
8. For a multipurpose room, I like
   - a. The T table, or similar type 6

C. Evaluation of Teachers Own

1. What features about the **arrangement** of the laboratory or lecture room have been **gratifying?**
   - a. T tables along two walls
   - b. Arrangement of storage cabinet
   - c. Adequate space and table arrangements are helpful.
   - d. I like the lab and lecture separate, with glass between
   - e. The system is a combination one, and it is convenient to give instructions before an experiment
   - f. Storage space very good
   - g. Storage room between the two, with openings to both
   - h. The fact that students do not sit at lab tables
   - i. Plenty of table space per student
   - j. Having lab facilities in back of my lecture room
   - k. Both in same room; easy to move from one to other
   - l. Light, durability, adequate space accessibility
2. What features about the **arrangement** have proven **unsatisfactory** from the standpoint of convenience of accessibility of equipment and materials, traffic, or effective use of the equipment?
   - a. Fume cabinet location

b. Everything except arrangement of storage cabinets

c. Tables are too heavy to move, otherwise "all is well." We have plenty of room from all angles.

3. What do you like best about your science facilities?
Teacher Response (Five of 13 recorded)

a. Sufficient supply of equipment and materials

b. Semi-micro Chem. Lab.

c. Convenience of utilities; arrangement of seating

d. Large storeroom; teacher demonstration desk

e. Basic and functional

4. What do you dislike or like least about your science facilities?
Teacher responses

a. Location of fume cabinet

b. Everything

c. Lack of electrical outlets on lab tables and insufficient number of sinks in water system. Also, no facilities for getting room dark enough for use of color films and bioscope.

d. Storage space could be improved. Need more microscopes.

e. Type of tables, and they are too close.

f. Combined lecture-laboratory room

g. Type laboratory tables (Long table with narrow trough)

h. At present could use more small standard items

i. Too much furniture in too small space

j. Too little time for preparations, no good microscopes, too little space

k. No hood; tables too close together; sink too small no storage space for students.

l. Crowded

m. On 4th floor

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